THE ITALIAN SUBMARINE FORCE IN THE BATTLE OF THE ATLANTIC: LEFT IN THE DARK

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As we reflect on World War II, our minds are often drawn to the atrocities of genocide, and graphic depictions of Nazi Concentration camps throughout Europe. Others reflect on the near 30 million deaths, civilian and military, that occurred in the fierce, destructive battles on the Eastern Front. Few reflect on the "largest, longest, and most complex Naval battle in history," the Battle of the Atlantic. This study analyzed the Battle of the Atlantic from September of 1939 to May of 1945. While studies of the Battle of the Atlantic have traditionally focused on the German submarine offensive, this thesis evaluated the effectiveness of the Italian submarine force as a force multiplier to the German offensive during both coordinated and independent submarine operations (in the Atlantic) from October 1940 to July 1943. This study found that while the Italians provided capable submarines to the German High Command for use in the Atlantic, they were largely ineffective during coordinated operations from October 1940 to May 1941. The research concluded that ineffective coordinated operations resulted from inadequate joint training prior to the conduct of coordinated operations and a failure by the German High Command to treat Italy as a capable ally. Although ineffective during coordinated operations, the Italian submarine force did show improved performance during independent operations from June 1941 to July 1943.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE ITALIAN SUBMARINE FORCE IN THE BATTLE OF THE ATLANTIC: LEFT IN THE DARK, by LCDR Kevin M. Moeller, 99 pages.

As we reflect on World War II, our minds are often drawn to the atrocities of genocide, and graphic depictions of Nazi Concentration camps throughout Europe. Others reflect on the near 30 million deaths, civilian and military, that occurred in the fierce, destructive battles on the Eastern Front. Few reflect on the "largest, longest, and most complex Naval battle in history," the Battle of the Atlantic. This study analyzed the Battle of the Atlantic from September of 1939 to May of 1945. While studies of the Battle of the Atlantic have traditionally focused on the German submarine offensive, this thesis evaluated the effectiveness of the Italian submarine force as a force multiplier to the German offensive during both coordinated and independent submarine operations (in the Atlantic) from October 1940 to July 1943. This study found that while the Italians provided capable submarines to the German High Command for use in the Atlantic, they were largely ineffective during coordinated operations from October 1940 to May 1941. The research concluded that ineffective coordinated operations resulted from inadequate joint training prior to the conduct of coordinated operations and a failure by the German High Command to treat Italy as a capable ally. Although ineffective during coordinated operations, the Italian submarine force did show improved performance during independent operations from June 1941 to July 1943.

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ACRONYMS

ADM	Admiral
ASW	Anti-submarine warfare
BDA	Battle damage assessment
C2	Command and Control
CDR	Commander
HF/DF	High frequency direction finder
MOE	Measure of Effectiveness
NM	Nautical Miles
US	United States
USMM	Italian Navy
WWI	World War One
WWII	World War Two

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CHAPTER 1

INTRODUCTION

On May 15, 1945, at the bottom of the Atlantic Ocean, lay 28 million tons of allied shipping, 8500 allied ships, 1000 U-boats, and the remains of 80,000 mariners (accounting for German submariners, allied merchantmen, and those serving aboard allied escort vessels). While the numbers may be disputed, the totality of unrestricted submarine warfare in the Atlantic theater spanning two world wars is undeniable, and the "graveyard" of the Atlantic very real.

The German invasion of Poland in September of 1939 ignited the second world war (WW II) of the twentieth century. As German forces swept decisively across the European continent, the United States remained neutral, protected largely by a vast Atlantic Ocean. Continuing west, the Germans soon held the sovereign borders of Britain visible in their cross-hairs. The Atlantic Ocean, which once provided protection for the United States, would soon become the grounds for the "largest, longest, and most complex naval battle in history."[1]

The critical importance of the Battle of the Atlantic is probably best summed up by Winston Churchill:

> The Battle of the Atlantic was the dominating factor all through the war. Never for one moment could we forget that everything happening elsewhere, on land, at sea, or in the air, depended ultimately on its outcome, and amid all other cares we viewed its changing fortunes day by day with hope or apprehension.[2]

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[1] David Syrett, *The Defeat of the German U-Boats; The Battle of the Atlantic* (Columbia, SC: University of South Carolina Press, 1994), Preface.

[2] Winston S. Churchill, *The Second World War Volume 5; Closing the Ring* (Boston, MA: Houghton Mifflin Company, 1951), 6.

At the onset of WWII, the vast ocean that afforded the United States protection from the German conquest in the European theater was filled with 13 million tons of sunken allied shipping, 5000 destroyed allied ships, 180 sunken U-boats, and the remains of some 20,000 mariners, all results from unrestricted submarine warfare during WWI. Nearing the brink of disaster, Britain adapted an escorted convoy system which proved to be the most effective strategy against submarine attacks.[3]

As WWII began, neither side (Allied or German) was necessarily prepared for unrestricted submarine warfare in the Atlantic. The British, having largely forgotten the lessons learned in World War I (WWI), were not prepared to provide the necessary escorts to protect the shipping imports required for their very survival. The Germans, while successful in WWI, had too few operational submarines in the Atlantic theater at the onset of WWII to fulfill Admiral (ADM) Karl Doenitz's preferred maritime strategy. Although initially unprepared for the onset of war, both sides exercised the flexibility required in shipbuilding, tactics, technology, and information dominance, resulting in a contracted battle of wills in the Atlantic Ocean.[4]

Wolf-packs, air escorted convoys, surfaced U-boat attacks, Asdic (sonar), and Enigma code breaking are all examples of tactics, technology, and information dominance concepts utilized individually, or in conjunction with each other, to change the tide of the battle in the Atlantic. While the factors just described were important, they are focused on Allied defensive measures and German U-boat offensive operations, and

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[3] Stephen Roskill, *Battle of the Atlantic. In Decisive Battles of the Twentieth Century* (New York: David McKay Publishers, 1976), 81-100.

[4] John T. Kuehn, *Agents of Innovation* (Annapolis, MD: Naval Institute Press, 2008), chapter 8 passim.

often ignore the contributions of the Italian submarine force (a numerically superior force as compared to the Germans with nearly twice as many operational submarines at the onset of the war). How effective was the Italian submarine force as a multiplier to the powerful German submarine force in WWII? What were the major factors which contributed to the Italian submarine force's effectiveness or ineffectiveness?

The *2011 National Military Strategy* of the United States defined the Asia-Pacific region as a region of increased and growing strategic importance. Rapid militarization and modernization by key regional powers is rapidly changing the regional security architecture, with unclear strategic intent.[5] In order to counter growing military threats in the region, and in a fiscally challenged environment, we will depend on regional allies as force multipliers in future regional conflicts. As such, how prepared is the United States as a military to effectively and efficiently conduct coordinated, multi-national operations against a near peer regional competitor?

Literature Review

While there is no shortage of primary and secondary source material on German U-boat operations in the Atlantic theater, there is a significant shortage of translated information available on Italian submarine operations during WWII. German War Diaries, the published, edited Fuehrer Conferences, and Intelligence reports provide insight into combined Italian-Navy submarine operations in the Atlantic, but are limited

[5] M.G. Mullen, *The National Military Strategy of the United States of America 2011* (Washington, DC: Joint Chiefs of Staff, 2011), accessed August 20, 2014, http://www.army.mil/info/references/docs/NMS%20FEB%202011.pdf.

to the German perspective.[6] While some secondary sources on Italian submarine operations during the war exist, they, too, are fairly vague and provide little depth when evaluating the effectiveness or ineffectiveness of the force during combined operations with the Germans. Overall, there appears to be very few translated Italian records from WWII, as compared to the amount of translated material available concerning German submarine operations. According to historian Cristiano D'Adamo, webmaster for Regia Marina Italiana, untranslated primary archival records for the Italian submarine force in WWII are maintained by the Italian Navy (USMM) and are located in Rome.[7]

An important primary source for this study is also Doenitz's *Memoirs, Ten Years and Twenty Days*, written by the Grand Admiral immediately following his release from the Spandau prison. Doenitz's Memoirs present evidence of German U-boat construction, tactics, crew training, and weapons, highlighting successes and failures of the U-boat campaign. Additionally, Doenitz's *Memoirs*, confirmed against Intelligence Reports, Fuehrer Conference Reports, and German War Diary entries, are used to provide insight into combined Italian-Navy submarine operations in the Atlantic, limited to the German perspective.[8]

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[6] U.S. Navy Department, *Fuehrer Conferences On Matters Dealing with the German Navy, 1939-1945*, trans. Office of Naval Intelligence (U.S. Navy Department, 1947), microfilm, 1, hereafter USN, FCGN.

[7] Cristiano D'Adamo is the webmaster for www.regiamarina.net, a web-site used extensively throughout this thesis for Italian submarine history and submarine operations at Bordeaux. In e-mail conversation on July 24, 2014, D'Adamo reported that he is one of few individuals who have translated archival records from the Italian Navy (USMM), and that these translations were used to build the extensive website that he now manages.

[8] Karl Doenitz, *Memoirs: Ten Years and Twenty Days* (Annapolis, MD: Naval Institute Press, 1990).

One additional primary source of interest is George Henry (G.H) and Roy Bennett's *Hitler's Admirals*. This source is a compilation of translated essays written by nine German admirals while being held as prisoners of war by the British in 1945.[9] The compilation of these essays provides an oral history of the naval campaign, and specifically those sections applicable to the Battle of the Atlantic will be highlighted in this thesis.

Statistics presented in this thesis were derived from Jürgen Rohwer's *Axis Submarine Successes, 1939-1945.* Rohwer's book was the outcome of more than 20 years of research and serves as a primary source for statistics throughout the Battle of the Atlantic. Each chapter is arranged by month, and presents statistics from engagements during the battle of the Atlantic to include reported tonnage sunk, latitude-longitude of the reported sinking, and the name/flag of the vessel sunk, among other items.[10]

Admiral Legnani's (former Secretary of the Italian Navy under Mussolini) memorandum, *Critical Examination of our Readiness and Results of our Submarine Warfare*, is one of very few primary sources detailing combined German-Italian submarine operations, from the Italian perspective. This memorandum details the perceived strengths and weaknesses of the Italian submarine force, and offers comparisons to the German U-boat fleet.[11]

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[9] George Henry Bennett and Roy Bennett, *Hitler's Admirals* (Annapolis, MD: Naval Institute Press, 2004).

[10] Jürgen Rohwer, *Axis Submarine Successes, 1939-1945* (Annapolis, MD: Naval Institute Press, 1983).

[11] Antonio Legnani, "Other Info, Critical Examination-1941," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=153&lid=1&cid=4.

Excerpts from *Regia Marina Italiana, Battle of the Atlantic*, by Cristiano D'Adamo are used as a secondary source to provide insight into the Italian submarine force. Articles from this collection provide technical specification details for the various classes of submarines operated by the Italians throughout the campaign as well as details concerning collaboration with the German Navy.[12] Additionally, the collection contained within the *Regia* Marina website (http://regiamarina.net) contains a translated oral history obtained from Mr. Mario Daneo. Daneo served on one of the most accomplished Italian submarines in the Atlantic, and provides insight into Italian submarine tactics.

Research Design

Initially, the study will review the capabilities and advances in Italian submarine design during the Interwar period. Part of this discussion will focus on German U-boat design and capabilities prior to the Versailles Treaty in order to draw comparisons between the two forces. This review will be based upon performance related characteristics such as speed, range, endurance, and standard operational depth restrictions. This component of the study will assess the state of the Italian submarine force at the beginning of WWII and its ability to influence combat operations in the Atlantic theater of operations. A comparison of German and Italian submarine capabilities will evaluate if the two platforms were physically comparable at the beginning of the WWII. From this comparison, a determination can be made if the two forces were similar from a capabilities standpoint, and highlight any differences as they may exist.

[12] Cristiano D'Adamo, "Battle of the Atlantic," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=89&lid=1.

Having developed an understanding of the similarities and differences between the German and Italian force from a capabilities based approach, the study will further develop comparisons of the forces through an evaluation of concepts of operations for each force. German submarine operating strategies in WWI, combined with details of Interwar submarine training and exercises, will be introduced as the foundation for German submarine concepts of operation at the onset of WWII. Additionally, an analysis of German training during the Interwar period, as outlined by Doenitz and his submarine commanders, will provide a further understanding of German operating strategies. Italian submarine operating strategies as evidenced by their involvement in the Spanish Civil War will be introduced as the foundation for Italian submarine concepts of operation at the onset of WWII. With an understanding of the two generalized concepts of operation, this study will compare the concepts, highlighting similarities and significant differences amongst them. From this comparison, a determination can be made if the two forces were similar from an employment standpoint, and highlight any differences as they may exist.

Inasmuch as it reflects the context for and operational effectiveness of the Italian Submarine fleet, the study will evaluate the effectiveness of the German submarine offensive from September of 1939 to May of 1945, presenting month by month statistics from the Battle of the Atlantic. The monthly statistics presented will focus on Allied ships sunk, Allied tonnage sunk, as compared to the number of German U-boat patrols conducted. Having established similarities and differences between the German and Italian submarine forces in the preceding analysis, the study will offer a predicted impact on Allied shipping based on increased Italian submarine operations (patrols) in the Atlantic theater at the onset of WWII. This prediction will be based on conservative

assumptions concerning the numbers of Italian submarines available at any given time to supplement German patrols in the Atlantic.

Italian submarine effectiveness will be evaluated with a concentration on their involvement in the Battle of the Atlantic. While the Italians were certainly involved in the Mediterranean theater, this thesis will focus on Italian submarine operations in the Atlantic. The study will evaluate the employment of Italian submarines by the Germans in the Battle of the Atlantic. How many Italian submarines were deployed to the Atlantic theater and what impact did they have to the overall Battle of the Atlantic? This study will evaluate the effectiveness of the Italian submarine force, evaluating the strengths and weaknesses in coordinated operations with the German submarine force. What were the key factors which made the Italian forces either effective or ineffective in coordinated operations with the Germans? Having developed effectiveness in the Atlantic theater, the study will conclude with an analysis of the overall effectiveness of coordinated Italian-German submarine operations, answering the primary research question.

The thesis consists of six chapters. The first chapter introduced the research question, a literary review, and methodology discussion. Chapter 2 will offer a statistical analysis of the German offensive in the Battle of the Atlantic from September of 1939 to May of 1945. Through a conservative projection, this analysis will establish the Italian submarine force as a potential force multiplier for the Germans. Chapter 3 examines the capabilities and advances of the Italian and German submarine forces during the Interwar period, provides comparisons of the two, and highlights significant differences that exist. Additionally, this chapter will detail both independent and joint German and Italian submarine crew training efforts. Finally, chapter 3 introduces operating concepts for both

forces. Chapter 4 will evaluate the effectiveness of the Italian submarine force in the Atlantic theater during the war, identifying strengths and weaknesses in its coordinated operations from both the German and Italian perspectives. Chapter 5 highlights Italian submarine successes in the Atlantic theater during independent operations from June 1941 to July 1943. Finally, chapter 6 provides final conclusions and offers insights for future research efforts.

CHAPTER 2

ITALIAN SUBMARINE FORCE: A POTENTIAL FORCE MULTIPLIER

Potential Significance of the Italian Submarine Force in the Atlantic

In the autumn of 1938, after declaring Great Britain as a possible adversary, the Commander in Chief of the German Navy (Grand Admiral Erich Raeder) directed a planning committee with the primary task of identifying the ways and means necessary to defeat the British, if called to war. The committee identified the destruction of the British merchant navy as the primary task of the German navy at the outbreak of war with Great Britain.

The Germans adopted economic warfare as the primary strategic plan to defeat the British, and described naval warfare as an integral part of economic warfare in Fuehrer conference reports dated 23 October 1939.[13] The strategic goal of economic warfare was to paralyze the enemy's economy, sever the enemy's economic reach to partnering nations, while protecting German access to the same, in an effort to break the will of the enemy (Britain) to continue the fight.[14] As such, paralyzing the enemy's (British) war economy by cutting off his supply lines became the primary offensive strategic goal of the German Navy.[15]

In response to this, the Germans developed a build plan known as the Z-Plan. While the Z-Plan called for the building of 233 submarines, during pre-war exercises

[13] USN, FCGN, 23 October 1939.

[14] Ibid.

[15] Ibid.

Doenitz identified 300 submarines as necessary for successful offensive operations against British convoy shipping.[16] The difference of 67 submarines presented a capabilities gap, exaggerated by Adolf Hitler's early declaration of war. The Z-Plan (233 submarines) envisaged the completion of a build plan by 1948; however, war came in September of 1939, significantly earlier than planned for. Because of this, at the onset of war, only five to seven boats could be actively engaged in offensive operations at any one time in the Atlantic.[17] Five to seven boats were not enough to utilize the wolf-pack tactics Doenitz rehearsed during the Interwar period, and might explain the poor results shown in table 1 exhibited during the early months of the war.

As Doenitz remarked at the conclusion of the U-boat Command war games in 1938-39:

> With the number of U-boats at present available and the additions that can later be expected on the basis of the current building programme, it does not appear that we shall be in a position, within the foreseeable future, either to exercise any materially appreciable pressure on Britain or to strike any decisive blow at her vital lines of supply, but shall have to content ourselves merely with a series of pin-pricks against her merchant navy.[18]

As claimed by Doenitz in his *Memoirs*, from the Spring of 1939 onwards he continuously pressed the German High Command for an increased build rate of the U-

[16] Doenitz, 33. Doenitz suggested in his memoirs (as a result of winter war games of 1938-1939) that 300 submarines were necessary to effectively wage war against Britain's shipping. Doenitz suggested that with 300 submarines, at any given time 100 submairnes would be in port, 100 submarines would be in transit to/from areas of operations, while the remaining 100 submarines were actively conducting offensive operations. Although Doenitz suggests that these conclusions were forwarded as a memorandum to Admiral Boehm, this research did not reveal said memorandum, and this fact is therefore based on the recollection of Doenitz himself.

[17] Ibid., 47.

[18] Ibid., 44.

boat arm, necessary for destruction of the British merchant shipping, identified as the strategic task of the German Navy *(Kriegsmarine).* It was not until December of 1940, some 14 months after the declaration of war that German High Command acknowledged the deficiencies in the submarine build plans. During the Fuehrer conference on December 27, 1940, ADM Raeder described the submarine construction program as inadequate, acknowledging deficiencies in the rate of construction, requesting the Fuehrer to call for the greatest possible progress in submarine construction.[19] Fuehrer reports from October through December of 1939 indicate that submarine construction was slowed due to insufficient supplies of key raw materials necessary to build such as iron, steel, and other metals.[20] Other reports suggest that the submarine program was not given priority in the first year of the war, suggesting the battleship as the capability necessary to achieve the desired end state on the high seas.[21]

While Doenitz placed great emphasis on convincing the German High Command that more German U-boats must be produced to achieve success, he spent little effort on preparing a formidable Italian submarine fleet as a force multiplier until October of 1940.

Italian Opportunities

In June of 1940, Italy entered the war and the "Axis Powers" were at last conjointly committed to war. The Italians entered the war with 115 operational

[19] USN, FCGN, 27 December 1940.

[20] Ibid., 23 October 1939 and 8 December 1939.

[21] Ibid., 11 July 1940.

submarines, one of the largest submarine fleets in the world.[22] In order to explore their potential impact, we must first make some rational assumptions about the number of Italian submarines operational and available for war patrols and their relative effectiveness. While this chapter will highlight the potential of the Italian submarine force, actual effectiveness will be evaluated in later chapters.

The first assumption that must be addressed concerns the number of operational submarines that could have been deployed for German use in June of 1940. As previously mentioned, the Italians entered the war with 115 operational submarines. Although the Italians had 115 submarines to offer, it is unreasonable to assume that the Italians would provide all of them to the Atlantic theater for joint operations with the German Navy (many were not ocean-going vessels). A more reasonable assumption must account for submarines retained for coastal defense of Italy, offensive operations in the Mediterranean, and submarines non deployable due to maintenance or crew training operations.

With these three factors in mind, it might be reasonable to assume that 40 submarines could have been deployed for Atlantic operations, 40 could have been retained for coastal defense, leaving 35 submarines in maintenance and training operations. Of note, Fuehrer conference reports from July 25, 1940, suggest that 36 Italian submarines were expected to be sent to the Atlantic theater by the end of October.[23] An additional 40 operational submarines in the Atlantic theater would

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[22] James J. Sadkovich, *The Italian Navy in World War II* (Westport, CT: Praeger, 1994), 20.

[23] USN, FCGN, 27 December 1940.

therefore add this number of available patrols for the Germans to exploit. Of the 40 available additional patrols, 20 patrols could be reasonably added to the German force at any given time (or 50 percent of the available fleet). This conservative addition accounts for submarines in post patrol maintenance and pre-patrol training cycles. This assumption is consistent with German plans, as Doenitz projected that with 300 submarines available, only 100 would be conducting war patrols at any given time, or one third of the available force.[24]

To evaluate the potential impact of the Italian submarine force, a significant assumption about their effectiveness must be made. For analysis purposes, it will be assumed that, if employed, the Italian submarine force would have been equally as effective as its allied German submarine force counterparts, where effectiveness of the German submarine force is defined as allied tonnage sunk divided by the total number of submarine war patrols conducted. In other words, the measure of effectiveness (MOE) for the German submarine force is defined as the allied tonnage sunk per month divided by the number of war patrols conducted during that month. Equality in effectiveness assumes that the two submarine forces were equally trained, had equally effective weapons employed with the same tactics, and had comparable submarine commanders. Although arguments exist where inequalities might be shown in each of these areas, it should be understood that these inequalities did not have to exist had the Germans trained the Italians during the Interwar period; or, had German commanders integrated with Italian submarine crews when the Italians entered the war in June of 1940.

[24] Doenitz, 33.

What cannot be projected in this analysis, is the change in efficiency with the increased numbers of patrols. With more submarines at his disposal, it can be argued that Doenitz could have covered a larger area of the Atlantic Ocean in his war patrols. Revealing a larger area, results in more contact with allied shipping. More contact, with equally effective weapons, results in a greater amount of allied tonnage sunk per month, and by definition, a higher effectiveness. Of note, the analysis offered is therefore reasonable, offering a prediction less than what may have been reasonably achievable. With these assumptions explained, a projected analysis can be performed to highlight the significant problems associated with the German strategy of excluding the Italian submarine force from their operations in the Atlantic.

Presenting the Delta: Axis Allies or Independent German Operations

Unrestricted submarine warfare in the Atlantic was employed in an effort to isolate Great Britain, a nation highly dependent on imports for survival. In light of this, control of the Atlantic was therefore vital to the survival of Great Britain.[25] It should therefore be clear why the analysis presents the amount of allied shipping sunk per war patrol as the MOE used to determine German U-boat effectiveness throughout the Battle of the Atlantic. This analysis presents monthly statistics from September of 1939 to May of 1945. Table 1 illustrates raw statistics for the first six months of the Battle of the Atlantic, covering a period of September 1939 to February 1940.

[25] Roskill, 1.

Table 1. Statistical Analysis from September 1939-August 1940

Month/Year	9/39	10/39	11/39	12/39	01/40	02/40
Number of U-boat Patrols	35	17	20	19	21	21
British Imports	2831000	3091000	3529000	3690000	3811000	3598000
Tonnage Sunk	200728	185305	77799	108347	173996	185405
Total Tonnage Shipped	3031728	3276305	3606799	3798347	3984996	3783405
Allied Tonnage lost per Patrol	5735	10900	3890	5702	8586	8829
Added Italian Patrols	20	20	20	20	20	20
Total Patrols (AXIS)	55	37	40	39	41	41
Estimated Allied Losses	315430	403311	155598	222397	339707	361981
Estimated Allied Ships Lost	82	81	60	96	113	105

Source: Created by author.

Variables important to this analysis include: British imports, tonnage sunk, total tonnage shipped, Allied tonnage lost per patrol, added Italian patrols, total patrols, estimated Allied losses, and estimated Allied ships lost. The total tonnage shipped variable accounts for British imports received and the amount of reported tonnage sunk. Allied tonnage lost per patrol is determined by dividing the total tonnage shipped by the number of U-boat patrols. A total number of axis patrols is determined by adding an additional 20 Italian patrols to the existing number of U-boat patrols. Estimated Allied losses are then determined by multiplying the total number of axis patrols by the Allied tonnage lost per patrol. Figure 1 is a graphical representation of the difference between

estimated allied tonnage sunk (German and Italian submarine operations) and actual tonnage sunk (German submarine operations).

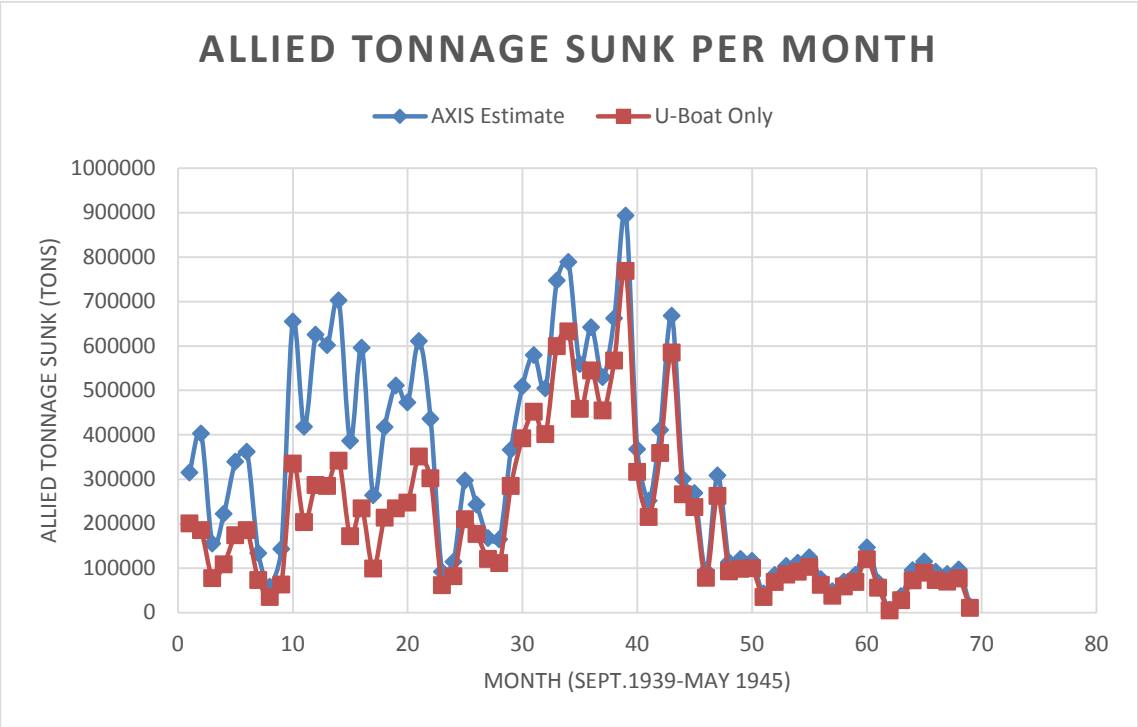

Figure 1. Allied Tonnage Sunk per Month (Axis vs. U-Boat)

Source: Created by author.

From table 1 it is clear that the greatest differences between reality and the projected improvements with added Italian submarine patrols exist in the first twenty months of the war. This result is consistent with data presented in that the fewest number of German war patrols occurred in the first twenty months of the war, where the limited number of available German patrols can be attributed to the restrictions imposed by the Treaty of Versailles and the amount of time required to re-build a German submarine force on the WWI model. While the Germans were building their submarine force, the

British were developing ship-building processes to compensate for the losses to the German U-boat threat, thereby maintaining the required imports necessary for their survival. The British ship-building process did not begin to compensate for losses until the Emergency Ship-Building Program was signed by the United States in January of 1941, some sixteen months after the start of the war. It took some time for this process to develop, and therefore the first twenty months of the war might be identified as a critical point, if the Germans were to achieve their objective in the Atlantic.

The data suggests that a concerted German-Italian submarine effort (AXIS effort) in the first twenty months of the war would have made offensive operations twice as effective as compared to independent German operations in the Atlantic. To validate this assertion we will evaluate Allied ships lost due to independent German operations, estimated Allied ships lost due to AXIS operations, tonnage sunk due to independent German operations, and estimated tonnage sunk due to AXIS operations.

Table 2. Factor of Effectiveness (AXIS vs Independent German Operations)

Allied Ships Lost (German Operations)	890	Allied Tonnage Sunk (German Operations)	3759556
Estimated Allied Ships Lost (AXIS Operations)	1827	Estimated Allied Tonnage Sunk (AXIS)	7784726
Factor of Effectiveness	2	Factor of Effectiveness	2

Source: Created by author.

Data suggests that in the first twenty months of the war 890 Allied ships were lost in the Atlantic due to independent German submarine operations, resulting in 3.8 million tons of lost shipping. Analysis suggests that coordinated AXIS submarine operations may have resulted in as many as 1827 allied ships lost, and some 7.8 million tons of lost shipping. In both categories, a combined AXIS effort results in twice the effectiveness as compared to independent German submarine operations in the Atlantic (consistent with Doenitz's statements in his *Memoirs*).

When reflecting on U-Boat operations from September 1939 to June 1940 Doenitz noted that:

> The results we could have obtained during these months had we had more boats are obvious and the point needs no elaboration. Apart, however, from the fact that the number of enemy ships sunk would have risen with each additional U-boat that entered the lists, an increase in the total number of U-boats brought a further, albeit indirect, advantage. The more boats there were, the more numerous were the pairs of eyes on the look-out, the easier became the task of finding convoys and the less became the time spent on fruitless search.[26]

Of note, the analysis presented above is not meant to be considered an exact projection of an outcome based on an increased number of Italian submarines sent to the Atlantic theater. Rather, the analysis confirms Doenitz's assertion that German successes and failures in the Battle of the Atlantic were directly related to the number of German U-boats available for his disposal.

The first twenty months of the war were critical for Germany to achieve the strategic aim of the German Navy. While the British were re-building the necessary escorts for convoy duties, the Germans were attempting to re-build a capable U-boat arm, dessimated at the end of WWI. Although, at the onset of war, Britain did not have enough

[26] Doenitz, 112.

escort vessels to implement the convoy systems effective at defeating the U-boat threat in WWI, the Germans did not have enough U-boats to execute unrestricted submarine warfare in the Atlantic.

In addition to not having enough submarines to execute unrestricted submarine warfare in September 1939, German compliance with the London Submarine Agreement of 1936 which limited U-boat attacks under "Prize Ordinance" restricted U-boat attacks on allied shipping.[27] While Doenitz suggests that unrestricted submarine warfare was not ordered until August 1940, FCGN reports from October 16, 1939, prove that unrestricted warfare against Britain (the primary strategic aim of the German Navy) was ordered much earlier.[28]

On October 16, 1939, the Fuehrer granted permission for the following measures:

> All merchant ships definitely recognized as enemy ones (British or French) can be torpedoed without warning. Passenger steamers in convoy can be torpedoed a short while after notice has been given of the intention to do so. The Commander in Chief, Navy points out that passenger steamers are already being torpedoed when they are proceeding without lights.[29]

Yet, in July 1940, the Germans gained an ally in Italy with a numerically superior submarine force. Although numerically superior, as assessment of the capabilies of the German and Italian submarine forces (and comparison thereof) is necessary to fully understand the missed potential that the Italian submarine force offered.

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[27] Ibid., 54-9.

[28] Ibid., 59.

[29] USN, FCGN, 16 October 1939.

CHAPTER 3

GERMAN-ITALIAN CAPABILITIES ASSESSMENT

Although dessimated by the 1919 Treaty of Versailles, under the leadership and strategic aims of the Nazi Party, the German Navy began a rearmament process in 1935. In similar fashion, during the Interwar period, the Italian Navy, led by the Fascist leader Benito Mussolini, moved to build a formidable Navy. While the Germans focused their initial building efforts towards a balanced fleet with a limited focus on U-boat production, the Italians focused their build efforts towards a robust submarine fleet capable of contolling the Mediterranean Sea.

German Flotilla-The Early Years

In August 1939, the German Navy possessed 56 U-boats, of which 21 were capable of conducting offensive operations in the Atlantic.[30] While initially the U-boats sailed with orders to obey international law governing attacks on merchant ships, those orders incrementally changed, and in August 1940, the Germans returned to unrestricted submarine warfare in the Atlantic, which had proved extremely effective in WWI.[31]

From the end of WWI to the onset of WWII, the Germans were under tremendous international pressures precipitated by their radical and perceived criminal actions during

[30] Ibid., 46.

[31] Doenitz suggests that unrestricted submarine warfare was not ordered till August 1940 and that German High Command incrementally relaxed Prize Rules during the first year of the war. While Prize Rules required the submarine to signal the merchant to stop, and to ensure the safety of the crew, German High Command incrementally relaxed these rules in response to perceived breaches of the agreement by the allies. Fuehrer Conference Reports show that Hitler ordered unrestricted submarine warfare against the British and French in October 1939.

the WWI. The terms of the Versailles peace treaty reduced the size of the German surface fleet and completely banned submarines. Compliant with the treaty, Germany disposed of its operational submarines, but having recognized the strategic importance of the submarine, it retained the design expertise, both paper and personnel, necessary to rebuild their fleet in the future. As noted by General Admirals Otto Schniewind and Karlgeorg Schuster in their joint essay, the mere presence of a viable U-boat force produced fear in the heart of an adversary, thereby restricting his freedom of action, and it was because of this that despite the major restrictions placed upon the Germans following WWI, they never abandoned their plans to develop and build a U-boat arm.[32]

By 1935, the Germans had regained a sense of national autonomy and repudiated the Versailles Treaty, which had to this point prevented them from openly arming. As Germany began to re-arm, Britain desired to limit Germany's activities, resulting in the Anglo-German Naval Agreement of 1936. As a result of the agreement, Germany was allowed to produce submarines at a rate of 45 per cent that of Britain with building to parity "should Germany deem it necessary."[33] The construction of U-boats focused on a large number of small U-boats, unsuitable for attacks on the major sea routes of Britain.[34]

Although it was now internationally acceptable for Germany to re-build its formidable submarine force, it was no surprise that it had U-boats in construction. Fearing the results of WWI, international pressure again brought Germany to the

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[32] Bennett and Bennett, 27.

[33] Bernard Ireland, *Battle of the Atlantic* (Annapolis, MD: Naval Institute Press, 2003), 17.

[34] Bennett and Bennett, 35.

negotiating table. The negotiations resulted in the London Submarine Agreement signed by Germany in November of 1936. The agreement made the destruction of commercial shipping illegal, except under defined prize rules.[35] In 1938, with war on the horizon, Hitler approved the so-called "Z-Plan" which called for the production of some 250 submarines, to be completed by 1943.[36] Although several admirals favored plans centered on a modern U-boat, with greater endurance and increased speed, the strong champions of the classical battleship won, and the Z-Plan therefore focused on a more balanced naval re-armament.[37] Nevertheless, the build plan, if complete, would allow Doenitz to impart his group attack theories, or wolf-packs, at the onset of war, certain to inflict tremendous losses to the British (although Doenitz proclaimed 300 U-boats were necessary to inflict the greatest casualties). Doenitz's desire did not come to fruition, since Hitler's "foreign policy" precipitated war in 1939, and only thirteen new submarines were in the construction process with none yet operational.[38] Doenitz went to war with a mere 56 operational U-boats, of which 21 were capable of operations in the Atlantic. Although Doenitz lacked the required number of submarines to implement wolf-pack tactics at the onset of war, he soon gained an ally with at least a numerically strong submarine force.

While Hitler did not initially envision, or desire a war with England (as expressed by many of Hitler's admirals), his actions precipitated a declaration of war that Germany

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[35] Ireland, 17.

[36] Ibid., 20.

[37] Bennett and Bennett, 37.

[38] Ireland, 20.

was ill-prepared to fight. Doenitz and General Admiral Hermann Boehm (commander of German Naval forces) described the state of the German Navy at the onset of war:

> ADM Doenitz: The war was in one sense lost before it began because Germany was never prepared for a naval war against England. The possibility of having England as an antagonist was not envisaged because the government was ill-advised politically.[39]
>
> Admiral Boehm: At the beginning of the war the German navy was in the first stage of its development and expansion. It was in no way comparable to the British fleet.[40]

However unsatisfactory the German fleet was vis-à-vis the conduct of war with Britain, the reality of war was upon the German fleet, and it was clear that operational planning had to be matched to existing resources.

German Flotilla: Technical Specifications

Contrary to modern day tactical employment of submarines, the German Navy in WWII, informed by lessons learned from a successful U-boat campaign in WWI and Interwar exercises, considered the U-boat to be an excellent torpedo vessel, very capable of conducting surfaced attacks against transiting merchants. Understanding the German strategy for the employment of its U-boat force is critical to explain the technical specifications important to the Germans, as these technical specifications made the U-boat more or less capable of accomplishing its mission.

Of the technical specifications which might be discussed, the Germans found surfaced U-boat speed, range, time required to submerge from a surfaced condition to a fully submerged condition, and the quantity of torpedoes which could be carried as most

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[39] Bennett and Bennett, 52.

[40] Ibid., 53.

important to achieving their strategic objectives in the Atlantic. After extensive consideration, the Germans found the golden mean to be a submarine of some 500 tons.[41] The Type VII (and its subsequent variants) became the preferred submarine for German use, and will form the basis for which much of the remaining technical discussion will be based on.

In the summer of 1935, the Germans had ten of the preferred Type VII submarines. These medium sized submarines were approximately 500 tons each, contained four bow and one stern torpedo tube, had a surfaced speed of approximately sixteen knots, the capability to carry 12-14 torpedoes, with a range of just over 6000 nautical miles (nm).[42] Over the course of the war, the Germans would develop two subsequent variants of the Type VII, the Type VIIb, and the Type VIIc. The Type VIIb variant added additional fuel storage, increasing its effective range from 6000 nm to just under 9000 nm, while maintaining the overall weight of the vessel and increasing its surface speed to seventeen knots.[43] The Type VIIc added additional capabilities with similar technical specifications to the Type VIIb variant.

German tactics, as developed during WWI and certified by exercises during the Interwar period, emphasized surfaced U-boat attacks against British convoys, under the cover of darkness. Merchant convoys found a speed of twelve knots to be the most efficient speed for transit across the Atlantic. In order to engage transiting convoys at the short ranges desired by Germans U-boat commanders, their vessels had to hold a relative

[41] Doenitz, 28.

[42] Ibid., 29.

[43] Ibid., Appendix I.

speed advantage over their target. Powered by electric motors only while submerged, the U-boats were limited to a maximum speed of eight knots, and could therefore not achieve the desired speed advantage required to engage their targets. As such, German U-boat tactics focused on surfaced U-boat attacks, leaving them vulnerable to counter-attacks from the enemy. Quickly submerging after an attack was therefore critical to the survivability of the U-boat fleet, and the Type VII U-boat could submerge in a mere twenty seconds.[44]

German Flotilla: Torpedo Design

The Germans recognized that while the design of the U-boat was critical to success in the Atlantic, equally critical was the design and effectiveness of the torpedoes they delivered. During the Interwar period, the Germans re-designed their weapon of choice. In order to minimize the wake and launch transients of the incoming torpedo, the Germans modified their WWI weapons, creating a torpedo propelled by electricity versus air pressure alone. Additionally, the warhead of the WWI torpedo was doubled in size, making it a significantly more powerful weapon as compared to its predecessor, and thus fewer weapons were required to achieve the same effects.[45] Most importantly though, the Germans re-designed the "trigger" of the torpedo, creating a magnetic pistol, as opposed to the impact pistol present on the torpedoes of WWI. The magnetic pistols were designed to detonate beneath the keel of its targets, and did not require impact with the

[44] Ibid., 29.

[45]Clay Blair, *Hitler's U-Boat War* (New York: Random House, 1996), 37.

target itself.[46] Again, the magnetic pistol was designed to improve the survivability of the U-boat by allotting more time to submerge prior to potential counter-action by an alerted adversary. While the concept was sound, German torpedoes suffered significant failures in the early stages of war.

In September of 1939 alone, thirteen skippers of German U-boats reported erratic or malfunctioning torpedoes.[47] Failures were not isolated to September of 1939, and were reported to the German High Command as evidenced in Fuehrer Reports dated 22 November 1939. On this date, ADM Raeder reported failures in both the magnetic firing devices and percussion fuses and largely attributed those failures to magnetic conditions, British countermeasures, and the rather frigid water temperatures.[48] German torpedo failures were articulated in Doenitz's *Memoirs* and described by commanders through communications with the German High Command. Examples include:

> April 18, 1940: U-37 reports multiple pre-mature torpedo explosions in the area between Iceland and the Shetlands.[49]
>
> April 19, 1940: U-47 reports attack on battleship with 2 torpedoes at a range of 900 yards with no success.[50]
>
> April 20, 1940: U-41 found themselves in favorable position to attack a convoy south-west of Westfiord, but refrained from doing so, as all confidence in torpedoes was lost.[51]

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[46] Blair, 37.

[47] Ibid., 103.

[48] USN, FCGN, 22 November 1939.

[49] Doenitz, 85.

[50] Ibid.

[51] Ibid., 89.

Excessive failures during the spring of 1940 resulted in investigations to determine their cause. The results of the investigations and subsequent studies revealed leaky balance chambers, required to ensure the torpedoes operated at the proper depths, and therefore necessary to ensure the magnetic pistols detonated once underneath the desired target. These faults were not be completely adjudicated until 1942. Reflecting on analysis presented in the second chapter, and having identified the first twenty months of the war as critical to German success in the Atlantic, the failures identified may be described as inhibitors to future German success.

In addition to the obvious impact of the torpedo failures (failure to sink desired targets), these failures had second and third order effects that impacted future operations. Failure of the torpedo to achieve successful hits had marked effects on the crews, as they lost confidence in the abilities of their U-boat weapon.[52] The confidence and dedication of the U-boat crew was absolutely critical to the success or failure of future U-boat operations.

German Flotilla: Crew Training

Shortly after assuming command of the German U-boat arm in July of 1935, Doenitz began a robust training regimen to restore the German U-boat arm to the formidable force that it was following WWI. Doenitz desired an enthusiastic submarine force in which each person possessed complete faith in their mission and their commanders.[53] He seemingly understood that success in future operations would hinge

[52] Bennett and Bennett, 71.

[53] Doenitz, 13.

on more than just professional skill alone, success would largely depend on crew support and enthusiasm.

The German submarine fleet set about the task of training the Weddigen Flotilla on October 1, 1935, some four years prior to the invasion of Poland.[54] The training program was designed to acclimate the crews to life aboard ship, under the harshest of conditions, with an emphasis on the development of the commanders ability to make rational and correct decisions, in the face of extreme danger.[55] The regimented training program was divided into six month schedules where each crew had to carry out 66 simulated submerged/surfaced attacks prior to conducting live torpedo firing exercises.[56] Crews quickly gained proficiency, improved in all areas of submarine operations, and showed an overall enthusiasm for their job and their service in the U-boat force. U-boat crews exhibited an extreme sense of pride and submarine operations were carried out with enthusiasm at all levels.[57]

A description of the first year of training as offereded by a former U-boat commander follows:

> The salient feature of this training year, 1935-36, was the fact that it eradicated from the minds of all the commanders and their crews the inferiority complex, which had undoubtedly been prevalent among them, and the idea that the U-boat

[54] The Weddigen Flotilla was the first U-boat unit of WWII founded on September 27, 1935 under the leadership of ADM Karl Doenitz.

[55] Ibid., 15.

[56] Ibid.

[57] Ibid., 16.

had been mastered and rendered impotent as an instrument of war by recent highly developed anti-submarine devices.[58]

German crews were certainly prepared for the task that lie ahead, and multiple exercises were conducted in the following years to perfect tactics proven during WWI and those modified during the Interwar period. Although Doenitz's crews had little to no actual war experience, Doenitz took personal responsibility to ensure that the crews of his submarine fleet could execute the tasks required of them, thereby creating arguably the best trained submarine fleet in the world, at the start of WWII.

German Flotilla: Concept of Operations

German submarine warfare during the First World War was the "global terrorism of its day."[59] German submarines patrolled innocent waters, conducting unrestricted commerce warfare against targets internationally recognized as conducting innocent passage. In fact, the Germans were so effective that in 1917, Herbert Hoover reported to President Woodrow Wilson that the Germans had sunk almost the entirety of the South American grain harvest bound for Europe.[60] While the German U-boat arm achieved great successes in the First World War, the introduction of the convoy system by the allies in 1917 "robbed it of its opportunity to become a decisive factor."[61] Only after

[58] Ibid., 17.

[59] John T. Kuehn, "Terrorists and Submarines: Lessons for Afghanistan from the Antisubmarine Campaign of World War I," *Joint Forces Quarterly*, no. 58 (3rd quarter 2010): 105-8.

[60] Ibid.

[61] Doenitz, 4.

finding relatively scarce convoys, lone U-boats found themselves isolated in attacks against huge formations of ships.

Doenitz, then a U-boat commander, first planned joint submarine attacks in October of 1918. Unfortunately, the planned rendezvous with a second U-boat never occurred, and after gaining contact on an enemy convoy, Doenitz was forced to continue with an independent attack. After obtaining at least one hit on the convoy, Doenitz found his U-boat in the middle of the convoy and under heavy attack from all sides.

> My supply of compressed air was exhausted, the boat had been hit and she was making water. I realized that this was the end and I gave the order 'All hands, abandon ship'. That was the end of my sea-going career in a U-boat in the First World War. That last night, however, had taught me a lesson as regards basic principles.[62]

This experience had convinced Doenitz that a U-boat attacking on the surface, under the cover of darkness had the best prospect for success.[63] Additionally, and in contrast to previous independent U-boat operations, he recognized the best method to counter allied convoy systems as simultaneous engagements from multiple U-boats.

After being appointed to raise the new U-boat arm in July of 1935, Doenitz set forth to build a submarine force capable of the skillfull execution of "torpedo-boat" tactics. During the Interwar period, U-boat commanders and crews were trained and tested on their ability to conduct coordinated, surfaced attacks, silhouetted by the darkness of the night sky.

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[62] Ibid., 4.

[63] Ibid.

Summary: German Capabilities Assessment

Under the leadership of ADM Doenitz, the German U-boat arm transitioned from a force dismantled by the 1919 Treaty of Versailles to one capable of waging unrestricted submarine warfare in the Atlantic. The Germans focused their build efforts towards the Type VII U-boat, a medium size submarine of some 500 tons, with adequate range, and rather good maneuverability. Throughout the course of the war, the Germans modified the Type VII adding additional fuel storage to increase the U-boats reach. As a result of lessons learned from WWI and Interwar submarine exercises, the Germans adopted surfaced, simultaneous, night attacks from multiple U-boats as their preferred tactic. Additionally, during the Interwar period, the Germans researched and developed improved torpedoes, fitted with magnetic firing pistols and electric engines. Finally, in an effort to prepare their submarine crews for future operations, the Germans executed a robust at sea training program, supervised by senior submarine staff officers, to include Doenitz himself.

Sommergible: June 1939

At the conclusion of WWI, the *Regia* Marina (Italian Navy) was conducting war using small submarines, capable of missions lasting 2-3 days, with minimal ranges, thereby limiting Italian submarine operations to the Mediterranean and Adriatic Seas.[64] This result is consistent with the strong defensive attitude suggested by the Germans in the *War Diaries* dated 03 July 1940, discussing Italys' attitude towards submarine

[64] Regia Marina translates in English to the Italian Navy where Sommergible translates in English to submarine. The Italians frequently referred to their submarine force as Sommergible.

warfare.[65] While the *Regia* Marina did not have a significant role in WWI, Mussolini, recalling the German operations of WWI, called for a more aggressive naval strategy, and dedicated Italy's resources to building a powerful, modern, and well equipped Navy.[66] Italian naval leaders such as Commander (CDR) Giuseppe Fioravanzo called for a defensive strategy, reliant on lighter naval vessels, such as the submarine.[67] As such, during the Interwar period, three distinct projects were developed, yielding eight new classes of submarines.[68] While the Italian Navy was largely built as a defensive measure and primarily for operations in the Mediterranean Sea, the aggressive building program during the Interwar period yielded submarines capable of long range patrols to the Atlantic theater.[69]

Of the oceanic classes designed, the Italians preferred three classes of submarines for operations in the Atlantic. Technical specifications discussed for comparison with that of the German U-boat are based on the *Marcello*, *Marconi*, and *Calvi* classes of Italian submarines. These classes account for the majority of the submarines deployed to the Atlantic theater, and might be described as the most successful classes of those sent.

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[65] Office of Naval Intelligence, trans., *War Diary: Operations Division, German Naval Staff, 1939-1945* (Wilmington: Scholarly Resources, 1984), microfilm, p. 1, hereafter ONI, GWD, 3 July 1940.

[66] Cristiano D'Adamo, "Italian Submarine Fleet," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text.asp?nid=82&lid=1.

[67] Ibid.

[68] Cristiano D'Adamo, "The Italian Submarine Base in Bordeaux, France," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text.asp?nid=90&lid=1.

[69] Ibid.

Sommergible: Technical Specifications

The *Marcello* class submarine, a large submarine of some 1000 tons, completed the most patrols in the Atlantic of any other class deployed to that theater (68 documented patrols by various *Marcello* class submarines). The *Marcello* class was capable of achieving speeds of seventeen knots on the surface and eight knots submerged. *Marcello* class submarines boasted a range of 7500 nm at a speed of nine knots, making the submarine more than capable of completing deployments to/from the Atlantic Ocean and abroad. Four torpedo tubes were located forward with an additional four stern tubes and the *Marcello* class had the capability to carry between 12-16 torpedoes. Although altered after arrival at Bordeaux, the submarines were built with a large, enclosed conning tower, resulting in a large silhouette and a significant tactical disadvantage.[70]

The six vessels of the *Marconi* class also displayed good seaworthiness during deployments to the Atlantic theater (although all but one were lost in the Atlantic), boasting the greatest successes of Italian submarines in the war against allied shipping.[71] In particular, the submarine *Da Vinci* was credited with seventeen allied sinkings in the Atlantic, for a total of 120,000 tons of allied shipping.[72] Much like the *Marcello* class, *Marconi* class submarines were large vessels, displacing some 1400 tons submerged. In

[70] Cristiano D'Adamo, "Marcello," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=164&lid=1.

[71] Cristiano D'Adamo, "Marconi Submarine-Oceanic: Marconi," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/classes.asp?class=Marconi&nid=165&lid=1.

[72] Cristiano D'Adamo, "Total Sinking: By Submarine," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/sub_actions_stat.asp?nid=195&lid=1.

comparison, the preffered, modified Type VIIc U-boat displaced some 517 tons while the long range Type IXc submarine (most successful long range class) displaced 740 tons submerged.[73] The *Marconi* class submarines could obtain a surface speed of eighteen knots and a submerged speed of eight knots. These large submarines could achieve a range of 10,000 nm at a speed of eight knots. This particular class had a similar armament to the *Marcello* class, and much like the *Marcello* class, these submarines had a large conning tower until modified at a later date to correct the tactical disadvantage.[74]

The *Calvi* class submarine was the largest of the three classes, displacing just over 2000 tons submerged at a length of 83 meters. Although the increased size of the submarine improved range and habitability, maneuverability of this class left something to be desired. Together, the *Calvi* class submarines conducted twenty Atlantic war patrols, accounting for 30 allied sinkings, and a total of 152,000 tons of allied shipping lost.[75] *Calvi* class submarines could achieve a surface speed of seventeen knots and a submerged speed of eight knots. Submarines of the *Calvi* class could range 11,000 nm at twelve knots (significant increased range as compared to the *Marcello* and *Marconi* classes) and had similar armaments to that contained by the *Marconi* and *Marcello* classes.[76]

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[73] Doenitz, Appendix 1.

[74] D'Adamo, “Marconi Submarine-Oceanic: Marconi.”

[75] Cristiano D'Adamo, “Cb Submarine Oceanic-Calvi,” Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/classes.asp?class=Calvi&nid=162&lid=1.

[76] Ibid.

Sommergible: Torpedo Design

In WWII, Italian submarines were armed with two caliber torpedoes, the 533, four mm and the smaller 450 mm. Although ten total G.7e advanced German torpedoes were used by the Italian Navy, they did not arrive (for reasons explained in the following chapter) until 1942. The advanced German torpedoes were more efficient, did not generate an incoming wake, thereby mitigating the risk of counter fire from the enemy, and utilized a magnetic fuse device, as opposed to an impact fuse device. Italian weapons used fuses of the "inertia pendulum" type, or impact fuses, resulting in detonation of the weapon on impact with the target. Domestic Italian torpedoes were propelled by over-heated air and reciprocal style engines.[77] Italian torpedoes frequently exhibited lower effectiveness due to the incomplete burning of the explosive and the partial deformation of the warhead during explosion of the weapon.[78]

Sommergible: Crew Training

The Italians recognized that the technical complexity of the submarine required specialized training and a new class of sailors.[79] Because of this, Italy established three distinct submarine schools, specializing in technical and operational training for their non-commissioned officers as well as their commissioned officers. While the schools

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[77] Francesco Cestra "Weapons: Torpedoes," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=103&lid=1&cid=2.

[78] Antonio Legnani, "Other Info, Critical Examination-1941," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=153&lid=1&cid=4, hereafter Legnani.

[79] Cristiano D'Adamo, "Italian Submarine Fleet," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text.asp?nid=82&lid=1.

were effective at producing trained personnel, the submarine schools were plagued by a shortage of personnel in attendance, where the shortage of personnel was attributed to the harsh and unhealthy conditions aboard diesel submarines, as well as the high casualty rates present in the submarine force.[80]

Consistent with experience from operations conducted during WWI and the Spanish Civil War, the Italians continued independent, submerged attacks against allied shipping. In response to improved capabilities of the British air forces in anti-submarine warfare, the Italians limited periscope depth and surfaced submarine operations, and relied instead on submerged detection of enemy merchant vessels.[81] Although evidence suggests that the Italians taught submarine operations in the schoolhouse, there is little evidence of independent exercises conducted to apply the established doctrine in the harsh realities of the open seas. While the Germans claim joint training exercises occurred shortly after the establishment of Bordeaux in July 1940, evidence suggests that Italian captains were largely prevented from training aboard German submarines.[82] It was not until May of 1941 that Italian officers and crews began training at the German submarine school on the attack procedures and methodologies employed by the Germans.[83]

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[80] Legnani

[81] Ibid.

[82] Cristiano D'Adamo, "Battle of the Atlantic."

[83] Cristiano D'Adamo, "Battle of the Atlantic: Collaboration with the German Forces and Early Successes," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=89&lid=1&cid=8.

Sommergible: Concepts of Operation

As discussed, German submarine experience in WWI, and their subsequent defeat by a robust allied convoy system, informed their tactics and training for WWII. The Germans adapted from independent submarine attacks to coordinated, simultaneous attacks (Rudeltaktik) under the cover of darkness.[84] The same cannot be said about the Italian submarine force.

Italian submarines in WWI were relatively small submarines, with limited range and limited ability to operate on the high seas. As such, Italian submarines were largely employed in coastal defense missions in the Mediterranean and Adriatic Seas. Under the leadership of Mussolini, and the subsequent re-structuring of the Italian Navy, submarines capable of long-range, open ocean deployments were created. The more modern, capable submarines were deployed by Fascist Italy in support of the Nationalists during the Spanish Civil War (November 1936-September 1937).

While the specific details of Italian submarine operations during the Spanish Civil War are not germane to this discussion, a brief history of their operations will serve as a foundation for operational tactics used during the Battle of the Atlantic. Italian submarines began unrestricted submarine warfare against Republican shipping in November 1936, concluding in September 1937 with the signing of the Nyon agreement, where they saw minimal successes.[85]

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[84] Rudeltaktik translates to pack-tactics, and is commonly translated to wolf-pack tactics.

[85] Stanley G. Payne, *The Spanish Civil War* (New York, NY: Cambridge University Press, 2012), 145. The Nyon agreement was named for the hosting city Nyon, Switzerland. The conference addressed attacks on international shipping in the

In summary, while the Italians appeared to have learned from the German experience in WWI of the significant potential of unrestricted submarine warfare, they did not apply German tactics during operations in the Spanish Civil War. As such, although Italian crews gained valuable operational experience, they saw few successes, a potential pre-cursor of future operations and performance. Italian submarine commanders continued to conduct independent submarine operations and attacks from periscope depth at the onset of operations in WWII.

Conclusion: Italian-German Submarine Force Capabilities Assessment

While the preferred Type VII German submarine and the three classes of Italian submarines were quite similar in surface speed, submerged speed, and range, the larger Italian submarines had distinct disadvantages in maneuverability and submergence times as compared to their German counterparts. The larger Italian submarines required between 60 and 120 seconds to fully submerge, whereas the smaller German submarines required only twenty seconds on average. As described previously, small submergence times are critical to ensure the survivability of a submarine following counter-attack from the enemy after initial detection. The quicker a submarine can disappear beneath the surface of the ocean, the more likely it is that an enemy attack will fail. Although the larger design of the Italian submarine certainly added time to that required to submerge, the overall lack of operational training (expanded upon later in this chapter) by the Italian Navy added to the time required for the crew to submerge the submarine. With additional training it can be reasonably asserted that the observed dive times could have been

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Mediterranean during the Spanish Civil War and specifically addressed Italy's execution of unrestricted submarine warfare against Republican shipping.

reduced. Additionally, the larger Italian submarines required more time to maneuver as opposed to their German allies. Legnani suggested that the larger Italian submarines had a surfaced turning radius of 500 meters (m), as opposed to a 300 m for the 500 ton Type VII German submarine.[86] Less maneuverability makes it more difficult to achieve a desired firing position relative to the enemy, and can complicate quick diving procedures.[87]

During the Interwar period, the Germans redesigned their torpedo, whereas the Italians largely kept to their original designs. The Germans developed a more powerful torpedo while building a weapon powered by an electric motor, thereby minimizing the launch transients, and counterdection risks.[88] Additionally, the Germans developed a magnetic firing pistol, as opposed to the traditional impact dependent fuse, designed to detonate beneath the keel of enemy ships, thereby inflicting maximum damage with a single hit. Although the German design was sound, in practice the German weapon did not perform to standards. Although corrected, the multiple failures and their negative impacts to the overall strategic aim of the German navy cannot be denied.[89]

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[86] Legnani

[87] Quick diving procedures are used to rapidly submerge the submarine from a surfaced condition to avoid potentially deadly counter-attacks from surface ships or aircraft

[88] Transients are described as unexpected sounds that are not natural to the ocean environment, which can be exploited by sonar operators to detect the presence of a submarine. Launch transients could be metallic in nature (caused the mechanical opening of torpedo tube doors), or general broad-band noise transients caused by the pressurization or flooding of torpedo tubes.

[89] Doenitz, 88-9. In response to multiple torpedo failures, on April 17,1940, Doenitz withdraws U-boats from the Norwegian coast and south Norway. At this time, Doenitz described the Norwegian coast as the crucial place in operations.

In contrast, the Italians largely stayed the course with their original torpedo design and focused on increased production of previous models. Italian torpedoes were propelled by over-heated air and reciprocal engines, making them more susceptible to counter-detection as opposed to the electric propelled torpedoes designed by the Germans.[90] The Italians utilized the impact fuse on their weapons, although they requested the German magnetic pistols for integration into their weapons system, only to be denied until later in the conflict.[91]

While both the Italians and the Germans identified adequate crew training as critical to the success of future submarine operations, the Germans developed a more robust training program, as compared to that of the Italians. The Germans developed surfaced wolf-pack attacks against Allied shipping, under the cover of darkness as their preferred method of attack during the Interwar period. After testing and refining these tactics while simultaneously re-building their U-boat arm, the Germans taught the tactics in the school house, and tested their crews' ability to execute the tactics through multiple at sea exercises. Commanders and crews of German submarines were tested and evaluated in war-like conditions, ensuring their readiness for at sea operations. In contrast, while the Italians conducted operational and technical training at their submarine schools, there is no evidence of the application of this training in robust at sea exercises. Additionally, while the Germans agreed to joint German-Italian crew training, the evidence examined here suggests that this training did not occur until May of 1941,

[90] Torpedoes propelled by over-heated air and reciprocal engines produced a wake which could be used to determine the location of the submarine from which the torpedo was intitially launched by which counter-attacks could be launched.

[91] USN, FCGN, 26 January 1940.

nearly one year after the entry of the Italians into the war, and precisely when coordinated German-Italian submarine operations were discontinued.

CHAPTER 4

COORDINATED OPERATIONS IN THE ATLANTIC

> Submarine warfare in the Atlantic is to be supported by Italian submarines. Therefore Bordeaux is to be expanded into a base. Operational command will be in the hands of the German Commanding Admiral, Submarines. Liaison officers will be exchanged for the purpose of coordination in tactical and operational matters.
>
> — U.S. Navy Department, FCGN, 6 September 1940

Just one month after entering the war in June 1940, the Italians offered a portion of their vast submarine fleet for duty in the on-going Battle of the Atlantic. As a means to accomplish their strategic end, the German High Command quickly accepted the offer and established an operational base in occupied Bordeaux, commonly referred to as Betasom. Both sides agreed that operational command of Italian submarines would remain with Doenitz, and liaison officers were assigned to establish the conditions necessary for effective coordinated operations.[92] It would appear as though Doenitz and the German High Command could now engage in the offensive operations necessary to achieve the strategic aims of the German Navy.

In addition to gaining a capable Italian submarine fleet, German Naval High Command incrementally lifted the restrictions on U-boat operations, which limited U-boat attacks under "Prize Ordinance" contained in the London Submarine Agreement of 1936.[93] Attacks on allied merchant shipping became less restricted, until the "whole of the seas" became available for attack without warning in August 1940.[94]

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[92] USN, FCGN, 6 September 1940.

[93] Under the Prize Ordinance, U-boats were required to surface, halt, and inspect merchant vessels prior to attack. Prior to sinking the vessel, if warranted under the

Italians Enter the War

The Italians entered the war in June 1940, honoring their promise as a part of the German-Italian Axis of power. Italy entered the war with a formidable Navy, boasting 115 operational submarines, amongst other capable assets within their fleet. While the Italian Navy focused efforts on more than its submarine force during the Interwar period, this chapter highlights the efforts of only its submarines. While the specifics of the Italian building plan during the Interwar period will not be presented, it is worth discussing the foundation of their fleet building plan during the Interwar period. The Italians were not competing with the British in the Interwar period, rather they focused their efforts on the Mediterranean in an effort to achieve parity with the French.[95] The necessity to achieve parity with the French was driven by Italian policy to match the maritime construction of the strongest continental power.[96] Specifically, in an effort to counter French battleships, the Italians developed one of the largest submarine fleets in the world. Thus, their submarine design efforts were directed towards operations in the Mediterranean Sea against Royal Navy surface ships and not in the Atlantic against anti-submarine warfare (ASW) forces and commercial shipping.

On July 24, 1940, the Italians offered to send a significant number of submarines to the Atlantic to complement German U-boat efforts in the Atlantic. It was clear to the

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conditions of the Prize Ordinance, U-boat commanders were required to ensure safety of the vessels' crew. Doenitz, 54-9.

[94] Ibid., 59.

[95] Sadkovich, 15.

[96] Ibid., 16.

German naval staff that while the Italian offer should be accepted, close tactical coordination between German and Italian submarines would be at first impossible.[97] Italian submarine crews did not have the training or expertise on German wolf-pack tactics developed during the Interwar period necessary for close tactical coordination. Recent German occupation of France offered new operating bases for the German U-boat forces to launch offenses against Allied shipping in the Atlantic. Captured French submarine bases offered new access with limited distances to the Atlantic theater of operations. As such, it took less time to transit on and off station, and submarines could spend more time on station. Therefore, more time could be spent in contact with the enemy.

The Italians seemed to offer Doenitz just what he later expressed as necessary for victory against Britain, additional submarines to maximize the effectiveness of developed wolf-pack tactics.[98] Tactically, the Germans did not have enough submarines to effectively impede British commercial traffic. To this end, the Italians provided a numerical advantage.[99]

As Doenitz reflected in October of 1939:

> At the onset of war, the critical point I have previously described, the numbers of U-boats available was not big enough for them to locate convoys on the high seas and deliver joint attacks against them.[100]

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[97] ONI, GWD, 24 July 1940.

[98] Doenitz, 43.

[99] Cristiano D'Adamo, "The Integration of Betasom with the German Command Structure," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text.asp?nid=95&lid=1.

[100] Doenitz, 62.

While arguing to the German High Command for more submarines during the Interwar period, Doenitz stressed increased numbers of available submarines as critical to the effectiveness of his recently developed wolf-pack tactics in two distinct ways. First, a greater number of submarines operating in concert with one another could mass a greater attack against a given convoy, thereby achieving greater effects. Secondly, he advocated increased numbers of operational submarines as critical to effective reconnaissance efforts. The importance of reconnaissance efforts in the Atlantic theater can be quite simply explained. Effective, coordinated attacks against allied shipping could only occur after initial contact with the convoys themselves. German wolf-pack tactics began with initial contact from a given U-boat, from which the attack by supporting U-boats could be coordinated. It was to this end that Doenitz saw the most significant advantage to be gained by the addition of Italian submarines to the Atlantic, as the Italian submarine provided 'more eyes,' which he greatly desired.[101]

When discussing the importance of aerial reconnaissance efforts with Hitler in 1943, Doenitz articulated the importance of reconnaissance to the conduct of war:

> For centuries it has been accepted without question that reconnaissance is an essential component of the conduct of war and that it must be carried out wherever and whenever the conduct of operations has need of it.[102]

On 25 July 1940, the Fuehrer (informed by Doenitz) accepted the Italians offer and 27 Italian submarines soon reported to Bordeaux for use in the Atlantic. Upon arrival, it was clear, and both sides agreed, that control of all submarine operations would lie with German submarine command. The Italian command directed submarine groups tasked

[101] Doenitz, 146.

[102] Ibid., 132.

with coordinated operations in the Atlantic to receive directives from Doenitz.[103] Since close tactical coordination was required to ensure maximum effectiveness, and in an effort to ensure the Italians had the opportunity to benefit from German experiences in the Atlantic theater, a liaison staff was created with the Italian submarine command in Bordeaux.[104] While German sources offer very little analysis on the effectiveness of the liaison staff, Italian sources suggest that the talented officers provided from both sides contributed to establishing a true sense of comradeship.[105] In general, it was clear to Doenitz that the Italian submarine crews and officers were very capable, and he asserted that he set forth to train these new assets for coordinated deployments with his well-trained U-boat crews. It seemed as though the assignment of these Italian submarines to the Atlantic should finally make possible operations against merchant shipping (identified as the key strategic task of the German navy), in accordance with German experience and operational plans.[106]

Early Phases of Coordinated Operations July-November 1940

As the twenty-seven Italian submarines arrived in Bordeaux, Doenitz recognized that before the Italian submarines could deploy in coordinated operations, the capable Italian crews and commanders needed to train to the German standards and operating

[103] D'Adamo, "The Integration of Betasom with the German Command Structure."

[104] USN, FCGN, 25 July 1940.

[105] D'Adamo, "The Integration of Betasom with the German Command Structure."

[106] ONI, GWD, 24 July 1940.

procedures. Specifically, Italian submarines continued the WWI era operating tactics of attacking submerged during daylight and surfacing at night,[107]compared to German U-boat tactics of attacking at night from the surface where the U-boat had significantly more mobility. Additionally, as discussed Italian submarines had been trained in peacetime to operate independently versus the proven German wolf-pack tactics. Because of this, Italian submarines were not as proficient as their German counterparts at locating and reporting the presence of the enemy, nor of maintaining contact with the enemy until the rest of the wolf-pack could be massed for an attack.[108] Each of these operating characteristics represent critical differences between the German and Italian submarine forces that had to be reconciled in order to achieve maximum effectiveness of the combined forces.

In an effort to train the Italian submarine crews, the Germans claim that Italian commanders set to sea on German U-boat war patrols and conducted training exercises as integral members of U-boat crews. Contrary to the German perspective, the Italians insist that submarine captains, in general, were not allowed to train aboard German submarines.[109] While the Germans suggest that Italian submarine captains frequently trained on board German U-boats, the Italians offer CDR Primo Longobardo as one of few examples of the occurrence of such cross training. It should be noted that CDR Longobardo, as captain of the submarine *Torelli*, was one of the most successful captains

[107] Sadkovich, 20.

[108] Doenitz, 147.

[109] D'Adamo, "Battle of the Atlantic: Collaboration with the German Forces and Early Successes."

in the Atlantic fleet, accounting for four allied ships sunk in just one patrol (January 1941). In total, *Torelli* sank seven allied ships for a total of 42,000 tons. Additionally, the Italians identify May 1941, after coordinated operations in the Atlantic were aborted, as the first occurrence of coordinated training efforts on German attack techniques and methodologies.[110]

Regardless of the extent of initial Italian submarine training, the first Italian submarines began combined operations with the Germans in October of 1940, two months after initially arriving at Bordeaux. While the Germans had years to develop and perfect wolf-pack tactics and Command and Control (C2) procedures, Doenitz allotted just two months of dedicated training time for the Italians to master German C2 procedures and tactics. Doenitz later opined that deficiencies in Italian training could not be made good in the course of a few weeks.[111] Doenitz's assertion might give validity to the Italian description of inadequate coordinated training efforts. Nonetheless, Doenitz's statement certainly supports the Italian view that an earlier collaborative training effort might have produced better results.[112]

As the month of November 1940 came to a close, the coordinated German-Italian submarine efforts in the Atlantic had failed to produce the results desired by Doenitz. In particular (according to the Germans) during operations in the Atlantic the Italians failed to bring German submarines into contact with the enemy, as reports were often late or

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[110] Ibid.

[111] Doenitz, 147.

[112] D'Adamo, "Battle of the Atlantic: Collaboration with the German Forces and Early Successes."

inaccurate. Italian sources recognize the communication difficulties offered by the Germans, but relate these failures to the German High Commands refusal to place German communication officers on board Italian submarines. As a result, after making initial contact with the enemy, the Italian submarines would have to inform Bordeaux which would in turn inform Paris, resulting in delays of one hour or more.[113] The Germans, however, described cases where German submarines came in contact and mounted joint attacks against allied shipping while the Italians failed to join these attacks.[114]

In all aspects of coordinated operations, the Italians had failed to achieve the impact Doenitz had envisioned. The Italians failed to serve as a force multiplier during coordinated attacks, and they failed to provide "more eyes" as desired by the Germans. To quantify that failure, between October and November of 1940, the Italians operated 243 days at sea, only accounting for one allied ship, for a total of 4886 tons of allied shipping sunk. In contrast, during that same time period, the Germans claim that their submarines forces totaled nearly 380 days at sea, accounting for 80 allied ships, for a total of nearly 435,000 tons sunk. In this same period, the Italian sources claim that 26,500 tons were sunk by Italians, in sharp contrast to the 310,565 tons sunk by the Germans.[115] Although the two perspectives disagree, the inferiority of the Italian submarine force as compared to the Germans during this period is obvious. Due to these

[113] Ibid.

[114] Doenitz, 146.

[115] D'Adamo, "Battle of the Atlantic: Collaboration with the German Forces and Early Successes."

initial failures, in December 1940, Doenitz assigned the Italian submarines to independent operations, generally to the south and west of the German wolf-packs.[116] From his perspective, after just two months of coordinated operations, coordinated Italian-German submarine operations had failed.

Coordinated Operations: A Perceived Failure

Doenitz explained the failure of coordinated submarine operations in terms of ineffective Italian submarine operational training, poor submarine design, and inexperienced Italian submarine crews. This suggests that inexperienced crews and ineffective operational training are closely related.[117] As explained, Italian submarines had traditionally trained for independent operations, conducting submerged daylight attacks (as opposed to surfaced night attacks the Germans prescribed), and were therefore unfamiliar with the group wolf-pack tactics of the German U-boat force. According to Doenitz, a few short weeks of training were simply not enough to train the Italian forces to effectively coordinate their operations.[118] Additionally, Italian submarines were not designed for operations in the Atlantic. Italian submarines had much larger conning towers, as opposed to German U-boats, which made them more visible and decreased their speed (an important factor for intercepting surface vessels with a relative speed advantage). In addition to their inadequate conning towers, Italian submarines did not have an air induction system for their diesel engines built into their conning towers, and

[116] Doenitz, 148.

[117] USN, FCGN, 14 November 1940.

[118] Doenitz, 147.

therefore had to maintain their bridge hatches open to facilitate air flow for their engines while on the surface. Open bridge hatches, in rough North Atlantic seas, facilitated sea water intrusion and high failure rates for electrical components in the control rooms of these submarines.[119] Neither of these design features seem to directly explain the failure of coordinated operations. Each deficiency was corrected in Bordeaux and in February 1941, Doenitz reluctantly tried coordinated operations once again. Unsuccessful coordinated operations continued until May 1941, when Doenitz aborted any further attempts at coordinated operations and abandoned the idea.[120] During this second period of coordinated operations, Italian sources suggest that the Germans sunk some 154,743 tons compared to the 12,292 tons sunk by the Italians.[121]

Notwithstanding the previous discussions of the contribution of inadequate training and material inadequacies to the perceived failures of the coordinated operations, Doenitz also identified the will of the Italian submariners, and a lack of endurance and toughness, as the primary contributors to the perceived failure in coordinated operations.[122]

For example, Doenitz wrote:

> Italian submarines exhibited great gallantry in submarine operations during World War One in attacks on British battleships. Convoy battles demand not only gallantry and the offensive spirit, but also the toughness and endurance required to carry out the exacting task of remaining for hours and days on end in close and

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[119] Ibid.

[120] Ibid., 149.

[121] D'Adamo, “Battle of the Atlantic: Collaboration with the German Forces and Early Successes.”

[122] Doenitz, 150.

> dangerous proximity to the enemy, compelled to abstain from engaging until all the other boats have massed for exacting attacks. The Italians could not do this, and therefore were of no great assistance to us.[123]

Accordingly, from May 1941 on, Italian submarines were assigned to independent operations where they saw moderate successes in the middle and south Atlantic.[124] Appendix A details Italian submarine successes from May 1941 to July of 1943, when the Italians conducted independent submarine operations in the middle and south Atlantic.

During coordinated operations, the Italians sunk just 2,300 tons of allied shipping per war patrol, in sharp contrast to the 13,500 tons sunk per German war patrol during the same period.[125] During independent operations in the mid and south Atlantic, the Italians enjoyed greater successes, sinking nearly 7000 tons of allied shipping per war patrol conducted.[126] The improvement in performance suggests that the Italians were better prepared for independent operations, and might have seen greater successes in the North Atlantic, if left to independent operations and independent C2.

Conclusion: Failure of Coordinated Operations

The German perspective of coordinated German-Italian submarine operations in the Atlantic was clearly communicated by Doenitz in the passage above. Using Tonnage sunk/submarine day at sea as the measure of effectiveness (MOE), it is clear that Italian

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[123] Ibid.

[124] Ibid., 149.

[125] See Table 3 and Table 4 in Chapter 5.

[126] See Table 3 and Table 4 in Chapter 5.

submarines performed poorly in coordinated operations, and provided little to the German Navy as force multipliers. The statistics presented suggest that the German U-boats sunk 1,144 tons per U-boat day at sea as compared to the mere 20 tons per Italian submarine day at sea during the period of coordinated operations. Italian sources share a similar perspective to that of the Germans and describe coordinated operations in the Atlantic as a failure. It should be noted that one of the primary objectives of Legnani's "Critical Examination memorandum" was to explore the deficiencies of the Italian submarine force as compared to the Germans.[127]

In his discussion of the potential reasons for failed coordinated operations, Doenitz suggested design, lack of training, and the will of the Italian submariners as root causes for their failed combined operations in the Atlantic. From the evidence presented, and the nature of the operations, the most significant failure of those offered should be the inadequate training of the Italian submarine force in coordinated German-Italian offensive operations. Doenitz's argument about Italian submarine design should largely be ignored as a root cause partially due to insufficient evidence to support the claim (little evidence to support that Italian submarine design impacted their operational effectiveness), as well as counter-vailing evidence of their relative effectiveness while conducting independent operations in the Middle and South Atlantic. Doenitz implies as much when stating that several short weeks of training (for the Italians) were simply not sufficient to ensure effectiveness of the coordinated efforts. While Doenitz focused a great amount of energy on arguing the High Command's building plan for the Navy, he

[127] Legnani.

placed very little effort in using the resources available with the Italian Navy to build an effective team capable of conducting coordinated offenses in the North Atlantic.

Generally, it can be argued that an overall sense of unwillingness to truly commit to coordinated operations resounds through German war records. Admiral Krancke described entry into the war by the Italians as a burden and described the Italian armed forces as inferior to most, despite numerical strengths (large submarine fleet).[128] The Fuehrer himself described the Italians as a burden, and an obligation, and refused to supply the Italian Navy with information on U-boat technological advantages such as the magnetic firing pistol, and improved fire control systems.[129] Even when agreements were made to share information with the Italians, the Germans remained very reserved in what they shared, in a perceived un-committed stance towards the Italians.

[128] Bennett and Bennett, 104.

[129] USN, FCGN, 26 January 1940.

CHAPTER 5

AFTER COORDINATED OPERATIONS: THE REST OF THE STORY

The remainder of this thesis highlights Italian submarine successes during the Battle of the Atlantic, analyzing factors that contributed to successful engagements. Italian torpedo deficiencies and resulting tactics will be presented and evaluated. The analysis will then compare the effectiveness (allied shipping sunk) of the Italian submarines while conducting coordinated versus independent submarine operations.

Italian Submarine Successes

Appendix A presents statistics on documented Italian submarine successes in the Atlantic, citing the date of attack, the submarine name, tonnage sunk, and the method of sinking. It is particularly important to note the method of sinking, since it provides insight into a potential fatal flaw of the Italian submarine force. As previously discussed, Italian submarines preferred to conduct attacks on merchants from periscope depth, as opposed to the preferred surface, night attacks of their German counter-parts. At periscope depth, the submarine's deck is completely submerged, leaving only a small portion of the periscope exposed above the water-line. From this position, the submarine could spot enemy shipping, and engage with an unlimited number of torpedoes, while watching the carnage unfold through the small viewing window on the periscope. While it is certainly possible to launch torpedoes from periscope depth, it is not possible to shoot a deck gun from periscope depth. As such, it is curious that the Italian submarine captains used artillery (deck guns) in concert with torpedoes for nearly 40 percent of the successful engagements in the Atlantic. Evidence suggests that Italian submarines commenced

attacks with torpedoes from periscope depth, and then surfaced to use deck guns to complete the attack. Evidence of this strategy is presented by Mario Daneo, a non-commissioned WWII submarine veteran of the Italian Navy, in a short manuscript left to detail his experiences throughout the conflict.[130]

Daneo was assigned to the submarine *Morosini*, and describes an attack conducted against a Dutch ship in October of 1941, somewhere in the middle Atlantic.

> We moved into position and then submerged to 7 or 8 meters to use the periscope. Two torpedoes forward and two aft were ready for launch. We heard orders from the captain "fire one", 15 seconds later "fire two", and after 30 seconds, which felt like an eternity, we heard two large explosions, one after another, muffled at a distance; we had reached the target. We returned to the surface and the ship was listing to one side and stopping. The second torpedo had hit the extreme stern where the propeller was located. We got close enough to see the crew members lowering the life boats into the water and getting away from the ship and closer to us, asking to be taken aboard. The captain replied that this would not be possible because they were enemy shipwrecked. We got even closer and prepared the deck gun at a distance of about 800 meters and then sank the ship.[131]

Logically, there seems to be two linked explanations as to why Italian submarine captains surfaced their submarines, assuming greater risk of deadly counter-attacks, in order to use deck guns to complete an attack. First, approach and attack tactics explain one possible reason. Analysis of Italian approach and attack tactics suggests that Italian submarines were trained to conduct attacks on surface ships from periscope depth, using torpedoes as their primary weapon.[132] There is no evidence that submarine captains were trained to begin an attack with the torpedo from periscope depth, then surface the

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[130] Cristiano D'Adamo, "I Remember....the War Diary of Mario Daneo, an Italian Submariner in Bordeaux," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text.asp?nid=293&lid=1.

[131] Ibid.

[132] Doenitz, 147.

submarine and use deck guns to finish. Against an enemy with a well-established anti-submarine air capability, this type of tactic might best be described as suicidal. Second, Italian torpedoes were often ineffective at sinking enemy merchant ships. Thus in order to ensure the ship was not salvaged, the crews had to finish the job with deck guns, something they had not anticipated and integrated into their tactics prior to the conflict. This appears to be the logical conclusion, barring further evidence, and is at least supported by Daneo's testimony and in other accounts offered by Admiral Legnani.

When discussing the inferiority of Italian weapons as compared to German weapons in his memorandum, Legnani suggested that impact style fuses and incomplete burning of the explosive on Italian weapons resulted in generally light damage to enemy units.[133] Specifically, as compared to impact type fuses, torpedoes configured with magnetic style fuses are designed to detonate beneath the hull of the enemy ship, where the resulting pressure wave is transmitted throughout the keel of the ship, resulting in significant damage. Torpedoes with impact style fuses detonate only upon impact with the target, and transmit their explosive power over a localized area of a ship's hull, and in some cases away from the ship's hull, thereby resulting in less damage as compared to the magnetic fuse configured weapons. Additionally, the effectiveness of the torpedo (as described by explosive power) was reduced by incomplete burning of the explosive and warhead deformation during the explosion.[134] The combination of the two flaws might

[133] Legnani.

[134] Ibid.

explain why Italian submarine captains did not achieve success with torpedo attacks alone (in 40 percent of documented attacks in the Atlantic).[135]

Using Legnani's account of deficiencies with the Italian torpedo, it seems reasonable that Italian submarine captains began their attack from periscope depth with their primary weapon of choice, the torpedo. After some time for observation, battle damage assessment (BDA) if you will, the submarine captain decided if further action might be warranted, and made a decision as to how to engage the enemy for a second time, if need be. It appears that because of initial failures, and a lack of faith in the torpedo as a whole, submarine captains avoided shooting further torpedoes and instead surfaced their submarine to finish the attack using deck guns. Once on the surface, the submarine became a prime target for violent counter-attacks from escort ships and aircraft alike (unless the ship attacked was sailing independently and out of the reach of allied air cover). Legnani suggests that torpedo failures alone were enough to defeat the Italian submarine force in his *Critical Examination* memorandum.

> But if the weapon is instead, due to built-in defects, incapable of sinking or even seriously damaging the target, then due to this main deficiency, there is no longer any ratio which is worth computing. This one deficiency alone is enough to destroy the fruits of all labor, all fervor, and sacrifices of the entire submarine fleet.[136]

Legnani implied here that failures of the torpedoes destroyed crew morale, which in turn undermined the submarine force as a whole. In other words, the extreme risk associated with the submarine mission was not worth the gain. It might also be argued

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[135] Statistics obtained from Jurgen Rohwer's, *Axis Submarine Successes*, 1939-1945.

[136] Legnani.

that Legnani was quite literal with his statement, in that the inability of the torpedo to destroy the target, ultimately resulted in the physical loss of the submarine and its crew. Although little evidence is available to confirm the first of these two propositions, evidence of Italian submarine losses might be used to confirm the second. Appendix B details the losses of the Italian submarine force throughout the entirety of WWII, to include all theaters of operation. In total, the Italian submarine force lost nearly two thirds of its operational force. During the Italian submarine operations in the Atlantic, the Italian submarine force lost just over half of the submarines deployed.[137]

Table 3 presents statistics on German-Italian war patrols, tonnage sunk, and tonnage sunk per war patrol during coordinated operations in the Atlantic (October 1940-May 1941). In summary, during coordinated operations, the Italians were ineffective, sinking just 2294 tons of allied shipping per war patrol conducted. In sharp contrast, the Germans averaged 13561 tons of allied shipping per war patrol during the same time period. When coordinated operations were discontinued in May 1941, both sides continued separate submarine operations for the remainder of the Battle of the Atlantic.

[137] Appendix B presents statistics on Italian submarine losses to include losses in the Atlantic theater.

Table 3. German-Italian Successes (October 1940-May 1941)			
German Patrols	182	Italian Patrols	70
Tonnage Sunk	2468041	Tonnage Sunk	160586
Tonnage Sunk/Patrol	13561	Tonnage Sunk/Patrol	2294

Source: Created by author. Statistics obtained from Appendix A, Appendix C, and "U-Boat Patrols," uboat.net, accessed August 21, 2014, http://www.uboat.net/boats/patrols/.

Table 4 presents statistics during independent German-Italian submarine operations in the Atlantic from June 1941 to July 1943. The data suggests that Italian submarines were three times more effective during independent submarine operations as compared to coordinated operations (using tonnage sunk per war patrol as a MOE). Additionally, the data suggests that German submarines were four times less effective during their subsequent operations, as compared to the period where they conducted coordinated operations.

Table 4. German-Italian Successes (June 1941-July 1943)			
German Patrols	2381	Italian Patrols	63
German Tonnage Sunk	8942570	Italian Tonnage Sunk	437996
German Tonnage Sunk/Patrol	3752	Italian Tonnage Sunk/Patrol	6952

Source: Created by Author. Statistics obtained from Appendix A, Appendix D, and "U-Boat Patrols," uboat.net, accessed August 21, 2014, http://www.uboat.net/boats/patrols/.

While the raw data shows the Germans to be almost 50 percent less effective at separate operations as compared to the Italians, this data does not account for the technological and operational changes employed by the allied forces during this time period. Since the scope of this thesis is limited to coordinated Italian-German submarine operations in the Atlantic, a brief synopsis will be presented to explain the disparity in statistics. First, following the abandonment of coordinated operations in May 1941, the Italian submarine force was limited to operations in the mid and south Atlantic, some distance from the traditional allied convoy routes to the north, and an area less frequented by allied anti-submarine air patrols. Second, it was not until the summer of 1941 that new construction and United States (US) aid provided enough escorts to begin an effective convoy system in the Atlantic.[138] Additionally, in 1941, allied convoys and their escorts were fitted with radar sets capable of detecting surfaced U-boats waiting to attack.[139] Convoys equipped with radar sets typically transited the more threatened, German patrolled convoy routes to the north. Similarly, in 1941, the Allies equipped convoys and escorts with high-frequency direction finder (HF/DF) equipment capable of detecting and geo-locating German radio transmissions.[140] Third, anti-submarine aircraft patrols became ever more present in the mid-north Atlantic, eventually accounting for some 289 U-boat losses.[141] Finally, and perhaps most importantly, British code breakers at Bletchey Park were able to decipher German naval codes following the capture of multiple cipher

[138] Syrett, 8.

[139] Ibid., 11.

[140] Ibid., 12.

[141] Ibid., 13.

materials to include a naval enigma code machine from U-110 in June of 1941.[142] Intercepted and decrypted German radio messages gave the Allies knowledge of U-boat patrol lines, from which they could divert the escorted convoys to avoid attack.[143] While the short analysis presented here is not complete, it should highlight a few of the technological and operational achievements obtained by the allies to better explain the disparity in German U-boat performance from May 1941 till July 1943 as compared to their Italian ally.

Summary: After Coordinated Operations

During coordinated operations with the Germans from October 1940 to May 1941, Italian submarines failed to provide the results Doenitz had desired. In fact, they were about one-sixth as effective as their German counterparts. However, during independent submarine operations in the mid-south Atlantic from June 1941 to July 1943, the Italians improved their effectiveness three fold, while the Germans' effectiveness decreased by the same factor as compared to coordinated operations.

While the degraded German performance might be explained as a result of allied technological and operational achievemnets, the improvement in Italian submarine performance should suggest that neither side was prepared to conduct coordinated submarine operations. In fact, the marked improvement suggests that the Italians would have been more effective throughout the war if allowed to conduct independent operations, under their own tactical command.

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[142] Ibid., 20.

[143] Ibid., 22.

The moderate Italian successes throughout the Battle of the Atlantic came at a tremendous cost. During the conduct of operations in the Atlantic, some 50 percent of the submarines which deployed did not return home. As a result of deficiencies with Italian torpedoes (not made right by German counterparts), Italian submarine captains placed their ships and crews in harm's way to press home attacks on allied shipping with deck guns. In hostile waters, and facing capable ASW allied forces, Italian crews demonstrated bravery, gallantry, and commitment to the overall strategic goals of the alliance. If only the same could be said about the Germans.

CHAPTER 6

CONCLUSION

In June of 1940, the Italian Navy entered World War II with one of the largest submarine forces in the world, and seemingly what Doenitz had professed necessary to achieve the strategic aim of the German High Command. While joint German-Italian submarine operations were attempted in the Battle of the Atlantic, they occurred over a short seven month period of time, and resulted in negligible results. The failure of joint submarine operations can be attributed to inadequate training and preparation of Italian submarine crews for coordinated operations and failure by the Germans to recognize and treat Italy as a true ally.

Failure of Coordinated Operations

The evidence analyzed in this thesis clearly suggests that coordinated German-Italian submarine operations in the Atlantic were a failure. Historians have long taken this view, as have post-war memoirs and analyses. However, the reasons given for why it failed is another matter altogether. Tactically, the addition of Italian submarines to the German Atlantic U-boat fleet did not provide the numerical advantage Doenitz had deemed necessary for success against allied merchant shipping in the Atlantic. He had the numbers, but not the predicted success rate. During coordinated operations from October 1940 to May 1941, the Italian submarine force was only capable of sinking an additional 23,000 tons of allied shipping per month. While better than nothing, the Italian submarines failed to contribute significantly to the strategic aims of the German Navy in the Atlantic. While Doenitz identified cultural and racial factors, such as the will, in other

words the nerve, of the Italian submariners and a lack of toughness therein, as the primary reasons for the failure of coordinated operations, evidence shows that in the face of real danger Italian crews performed their missions till completion, even if it meant surfacing the submarine in suicidal conditions to finish an attack with gun fire after less than effective torpedo attacks. Legnani suggests that the Italian submarine force was unsuccessful because of its inferior technical characteristics, especially its torpedoes, as compared to its German counterparts.[144] The evidence suggests the submarine designs involved were comparable in the technical aspects that matter for operations conducted against merchant shipping. Instead, the failure of coordinated operations can be attributed to inadequate training and preparation of Italian submarine crews for coordinated operations and a failure of the Germans to recognize, plan for, and treat Italy as a true ally. This last failure translated down to the working relationship between the two navies.

From the research conducted, it appears as though coordinated German-Italian submarine training did not begin until the transfer of the Italian submarine *Giuliani* from Bordeaux to Gotenhafen in April of 1941, just one month prior to the abandonment of coordinated operations. While the Germans claim that coordinated training began upon arrival of Italian submarines in Bordeaux, evidence does not exist to support Doenitz's claims. At best, and according to the Germans, joint submarine schooling began as soon as Italian submarines began to arrive at Bordeaux, and Italian submarine captains began at sea training with German U-boat commanders in July 1940. At worst, and according to the Italians, coordinated submarine schooling did not begin until May 1941, and Italian

[144] Legnani.

submarine captains were rarely allowed to train on board German submarines.[145] At best, Italian submarine crews were allotted just two months of training and preparation before conducting their first war patrols, in coordinated operations with the Germans. Just two months were allotted to perfect the tactics that the Germans had developed and rehearsed since the end of WWI. Accordingly, Italian submarine captains continued to launch attacks against merchant shipping from periscope depth, using less effective torpedoes, instead of adopting the tested attack procedures of the German U-boats (surfaced attacks under the cover of darkness).

In comparison, German submarine crews were put through a battery of at sea testing prior to deployments, and personally certified by Doenitz or a trusted staff member. Additionally, there is no evidence of coordinated, joint Italian-German submarine exercises prior to the first Italian war patrols in the Atlantic. It should be of no surprise, then, that communication problems, critical to any coordinated operations, existed. Doenitz suggested that Italian submarines could not bring U-boats into contact with the enemy due to inaccurate and untimely communications.[146] However, it seems more likely that failures to properly communicate can be attributed to the German High Command's unwillingness to place German communication personnel onboard Italian submarines.[147] After sighting an enemy vessel, and without a German communicator on board, the Italians had to route communications through Bordeaux, then to Paris, then

[145] D'Adamo, "Battle of the Atlantic: Collaboration with the German Forces and Early Successes."

[146] Doenitz, 146.

[147] D'Adamo, "Battle of the Atlantic: Collaboration with the German Forces and Early Successes."

back to the German U-boats, which created obvious, significant time delays. Historian Cristiano D'Adamo summarized the importance of training to the Italians:

> The experience acquired training with the Germans was very valuable and demonstrated that, if collaboration had started earlier, it could have produced better results.[148]

The evidence reviewed in this thesis further suggests that the Germans viewed the Italians as an inferior partner, instead of as an ally capable of helping Germany achieve its strategic aims. The Fuehrer Adolf Hitler, before Italian entry into the war, described the Italians as "burdens and obligations."[149] It was to this end that Italian requests for magnetic firing pistols, or technical plans to manufacture magnetic pistols, and much needed fire control equipment were denied by the German Supreme Command of the Armed Forces staff (Oberkommando der Wehrmacht). While the Germans initially had difficulties with the magnetic firing pistols on their own torpedoes, these deficiencies were eventually worked out and the mechanism proved to be very reliable, as compared to the antiquated impact fuse. In order to achieve similar successes and in an effort to resolve the ineffectiveness of their own weapons, the Italians desired to obtain the magnetic firing pistol from the Germans. Yet, for reasons not fully explained in German records, the Germans refused. Similarly, as already noted, the Germans refused to place German communicators on board Italian submarines, with predictable results as discussed above.

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[148] Cristiano D'Adamo, "Battle of the Atlantic: End of Joint Operations," Regia Marina Italiana, accessed July 29, 2014, http://www.regiamarina.net/detail_text_with_list.asp?nid=89&lid=1&cid=7.

[149] USN, FCGN, 26 January 1940.

Coordinated German-Italian submarine operations in the Battle of the Atlantic failed to produce the results necessary to achieve the strategic goals of the *Kriegsmarine*. First, coordinated training efforts were ineffective at preparing the German-Italian submarine forces for coordinated operations in the Atlantic. Second, the German High Command viewed the Italians as inferior partners instead of capable allies. As such, both sides were ill-prepared for the conduct of coordinated operations and could not produce a strategic win during one of the most critical battles of the second world war.

Further Research Opportunities

Historical research and writing in English conducted on the Battle of the Atlantic largely focuses on the efforts of the *Kriegsmarine* against allied shipping, and allied anti-submarine efforts to counter the effectiveness of the German U-boat threat. Little research has been completed on the combined efforts of the German-Italian submarine forces, and there exists a multitude of research opportunities and lines of inquiry to pursue. Additional research is warranted into Italian submarine training, Italian submarine torpedo design, and coordinated operations in the Mediterranean theater during WWII.

Italian submarines conducted unrestricted submarine warfare in the Mediterranean Sea during the Spanish Civil War from November 1936 to September 1937. Additionally, the Germans deployed a small number of submarines to conduct similar operations under an operation code-named *Operation Ursula*.[150] Further research into these operations

[150] Operation Ursula, code-named after ADM Doenitzs' daughter, lasted from November 30, 1936 to December 10, 1936. During this time, submarines U-33 and U-34 were sent to the Mediterranean with a covert mission to attack Spanish Republican

might provide additional insights into the effectiveness and training of the Italian submarine forces.

Specifically, the evidence provided in this thesis identifies a disparity in the German and Italian perspective about the conduct of coordinated submarine training prior to the first war patrols conducted by the Italians in the Atlantic. While the Germans claim that coordinated submarine training occurred prior to the conduct of Italian war patrols in the Atlantic, Italian accounts do not necessarily support this. Additional research might provide insight into the extent of coordinated training that occurred prior to war patrols in October of 1940.

In an effort to limt the focus of this study, neither independent Italian submarine operations nor coordinated Italian-German submarine operations in the Mediterranean were explored. Further examination of Italian submarine operations in the Mediterranean might provide additional insight into Italian submarine training, tactics, weapon design, and overall effectiveness. While coordinated German-Italian submarine operations in the Mediterranean were limited, an examination of these efforts, where possible, might provide additional evidence of reasons for successes and failures of coordinated operations.

Finally, as the United States defense budget shrinks following over a decade of overwhelmingly land-focused war, the United States is certain to become more reliant on its trusted allies as force multipliers for future conflicts. As such, a detailed analysis of the particular failure by an Italo-German naval partnership in coordinated operations

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warchips. Julio de le Vega “Operation Ursula and the Sinking of Submarine C-3,” uboat.net, accessed August 19, 2014, http://www.uboat.net/articles/59.html.

might provide insights for defense policy-makers and analysts. In particular, an analysis of coordinated international training exercises and cross training efforts may reveal weaknesses, which if acted upon now, may improve the effectiveness of future coordinated operations, if and when those operations are required.

APPENDIX A

ITALIAN SUBMARINE SUCCESSES IN THE ATLANTIC

Date	Submarine	Tonnage	Method
8/12/40	*Malaspina*	8406	Torpedo
8/21/40	*Dandola*	3768	Torpedo
8/26/40	*Dandola*	5187	Torpedo
9/14/40	*Emo*	5199	Torpedo and Artillery
9/18/40	*Bagnoli*	3302	Torpedo
9/19/40	*Marconi*	330	Torpedo
10/1/40	*Baracca*	3687	Artillery
10/5/40	*Nani*	356	Torpedo
10/12/40	*Tazolli*	5135	Torpedo and Artillery
10/15/40	*Capellini*	5186	Artillery
10/27/40	*Nani*	1583	Artillery
11/9/40	*Marconi*	2734	Torpedo
11/18/40	*Baracca*	4866	Torpedo
12/1/40	*Argo*	1337	Torpedo
12/5/40	*Argo*	5066	Torpedo
12/18/40	*Veniero*	2883	Torpedo
12/19/40	*Bagnolini*	3660	Torpedo
12/20/40	*Calvi*	5162	Torpedo
12/21/40	*Mocenigo*	1253	Torpedo

Date	Submarine	Tonnage	Method
1/5/41	*Capellini*	5029	Torpedo and Artillery
1/14/41	*Capellini*	7472	Torpedo and Artillery
1/15/41	*Torelli*	5101	Torpedo
1/15/41	*Torelli*	4079	Torpedo
1/16/41	*Torelli*	3111	Torpedo and Artillery
1/20/41	*Marcello*	1550	Artillery
1/28/41	*Torelli*	5198	Torpedo
1/31/41	*Dandola*	1367	Torpedo
2/14/41	*Bianchi*	4517	Torpedo
2/23/41	*Bianchi*	5360	Torpedo
2/24/41	*Bianchi*	3385	Torpedo
2/27/41	*Bianchi*	6803	Torpedo
3/14/41	*Emo*	5759	Torpedo
3/24/41	*Veniero*	2104	Torpedo and Artillery
4/15/41	*Tazzoli*	4733	Torpedo and Artillery
5/7/41	*Tazzoli*	4310	Torpedo
5/9/41	*Tazzoli*	8817	Torpedo
5/20/41	*Otaria*	4662	Torpedo
5/30/41	*Marconi*	8129	Torpedo
6/1/41	*Marconi*	318	Torpedo
6/6/41	*Marconi*	3395	Torpedo

Date	Submarine	Tonnage	Method
6/6/41	*Marconi*	1392	Torpedo
6/13/41	*Brin*	3460	Torpedo
6/16/41	*Brin*	3781	Torpedo
6/28/41	*Da Vinci*	6619	Torpedo
7/14/41	*Morosini*	5358	Torpedo
7/14/41	*Malaspina*	3576	Torpedo
7/15/41	*Morosini*	8194	Torpedo
7/17/41	*Malaspina*	4402	Torpedo
7/21/41	*Torelli*	8913	Torpedo
7/25/41	*Barbarigo*	5135	Torpedo
7/26/41	*Barbarigo*	8272	Torpedo
8/12/41	*Tazzoli*	5449	Torpedo
8/14/41	*Marconi*	2689	Torpedo and Artillery
8/19/41	*Tazzoli*	7313	Torpedo
9/5/41	*Baracca*	434	Torpedo
1/23/42	*Barbarigo*	5473	Torpedo
2/20/42	*Torelli*	7224	Torpedo
2/25/42	*Da Vinci*	3557	Torpedo
2/25/42	*Torelli*	9245	Torpedo
2/28/42	*Da Vinci*	3644	Torpedo
3/6/42	*Tazzoli*	1406	Torpedo and Artillery

Date	Submarine	Tonnage	Method
3/6/42	*Finzi*	7011	Torpedo
3/7/42	*Tazzoli*	3156	Torpedo and Artillery
3/7/42	*Finzi*	4528	Torpedo and Artillery
3/9/42	*Tazzoli*	5785	Torpedo and Artillery
3/10/42	*Finzi*	9957	Torpedo
3/11/42	*Tazzoli*	3628	Torpedo and Artillery
3/12/42	*Morosini*	5966	Torpedo
3/13/42	*Tazzoli*	6434	Torpedo and Artillery
3/15/42	*Tazzoli*	8780	Torpedo and Artillery
3/16/42	*Morosini*	6341	Torpedo and Artillery
3/23/42	*Morosini*	9741	Torpedo and Artillery
3/29/42	*Calvi*	4589	Torpedo
3/31/42	*Calvi*	7452	Torpedo and Artillery
4/8/42	*Calvi*	7138	Torpedo and Artillery
4/11/42	*Calvi*	2161	Torpedo and Artillery
4/12/42	*Calvi*	7691	Torpedo and Artillery
5/18/42	*Barbarigo*	5052	Torpedo and Artillery
5/19/42	*Cappellini*	5747	Torpedo and Artillery
5/28/42	*Barbarigo*	4836	Torpedo and Artillery
5/31/42	*Cappellini*	8214	Torpedo and Artillery

Date	Submarine	Tonnage	Method
6/2/42	*Da Vinci*	1087	Torpedo and Artillery
6/7/42	*Da Vinci*	6956	Torpedo
6/10/42	*Da Vinci*	5483	Torpedo and Artillery
6/13/42	*Da Vinci*	6471	Torpedo and Artillery
6/15/42	*Archimede*	5586	Torpedo and Artillery
6/30/42	*Morosini*	5327	Torpedo and Artillery
8/1/42	*Tazzoli*	5497	Torpedo
8/6/42	*Tazzoli*	6161	Torpedo
8/10/42	*Giuliani*	5444	Torpedo and Artillery
8/13/42	*Giuliani*	5441	Torpedo and Artillery
8/14/42	*Giuliani*	5218	Torpedo
10/9/42	*Archimede*	20043	Torpedo
11/2/42	*Da Vinci*	7009	Torpedo and Artillery
11/3/42	*Cagni*	3845	Torpedo
11/4/42	*Da Vinci*	6566	Torpedo and Artillery
11/10/42	*Da Vinci*	7176	Torpedo and Artillery
11/11/42	*Da Vinci*	5291	Torpedo and Artillery
12/12/42	*Tazzoli*	5032	Torpedo and Artillery
12/12/42	*Tazzoli*	5658	Torpedo
12/21/42	*Tazzoli*	4814	Torpedo and Artillery

Date	Submarine	Tonnage	Method
12/25/42	*Tazzoli*	5011	Torpedo
2/24/43	*Barbarigo*	3453	Torpedo
3/2/43	*Barbarigo*	3540	Torpedo and Artillery
3/3/43	*Barbarigo*	8591	Torpedo
3/14/43	*Da Vinci*	21517	Torpedo
3/19/43	*Da Vinci*	7628	Torpedo
3/28/43	*Finzi*	3689	Torpedo
3/30/43	*Finzi*	5575	Torpedo
4/8/43	*Archimede*	3972	Torpedo
7/25/43	*Cagni*	22048	Torpedo
Total Tonnage Sunk		603,171	
Sunk Using Artillery/Combination		43	
Sunk Using Torpedo only		68	
Percent Sunk using Artillery		39%	

APPENDIX B

ITALIAN SUBMARINE LOSSES (All Locations)

Sumarine	Date	Fate	Location
Acciaio	7/13/43	Sunk	MED
Adua	9/30/41	Sunk	MED
Alabastro	9/14/42	Sunk	MED
Ametista	9/12/43	Scuttled	Adriatic
Anfitrite	3/6/41	Scuttled	MED
Archimede	4/15/43	Sunk	Atlantic
Argento	8/3/43	Scuttled	MED
Argonauta	6/29/40	Sunk	MED
Ascianghi	7/23/43	Sunk	MED
Asteria	2/17/43	Sunk	MED
Alpino Bagnolini	3/11/43	Captured	MED
Baracca	9/8/41	Sunk	Atlantic
Barbarigo	6/16/43	Sunk	Atlantic
Berillo	10/2/40	Scuttled	MED
Bianchi	7/5/41	Sunk	Atlantic
Bronzo	7/12/43	Captured	MED
Calvi	7/15/42	Scuttled	Atlantic
Cappellini	9/8/43	Captured	Bay of Bengal

Submarine	Date	Fate	Location
Capponi	3/31/41	Sunk	MED
Carracciolo	12/11/41	Sunk	MED
CB 13	3/23/45	Sunk	Adriatic
CB 17	4/3/45	Sunk	Adriatic
CB 18	3/31/45	Sunk	Adriatic
CB 21	4/29/45	Sunk by Germans	N/A
CB 5	6/13/42	Sunk in Yalta	N/A
Cobalta	8/12/42	Sunk	MED
Corallo	12/13/42	Sunk	MED
Da Vinci	5/23/43	Sunk	Atlantic
Dagabur	8/12/42	Sunk	MED
Delfino	3/23/43	Sunk	MED
Dessie	11/28/42	Sunk	MED
Diamante	6/20/40	Sunk	MED
Durbo	10/18/40	Scuttled	MED
Emo	11/10/42	Sunk	MED
Faa Di Bruno	10/31/40	Sunk	Atlantic
Ferraris	10/25/41	Scuttled	Atlantic
Fisalia	9/28/41	Sunk	MED
Flutto	7/11/43	Sunk	MED

Submarine	Date	Fate	Location
Foca	10/15/40	Sunk	MED
Galilei	9/19/40	Captured	Gulf of Aden
Galvani	6/24/40	Sunk	Gulf of Oman
Gemma	10/8/40	Sunk	MED
Giuliani	9/8/43	Captured	Pacific
Glauco	6/27/41	Scuttled	Atlantic
Gondar	9/30/40	Scuttled	MED
Gorgo	5/21/43	Sunk	MED
Granito	11/9/42	Sunk	MED
Guglielmotti	3/17/42	Sunk	MED
Iride	8/22/40	Sunk	MED
Jantina	7/5/41	Sunk	MED
Lafole	10/20/40	Sunk	MED
Macalle	6/15/40	Sunk	Red Sea
Malachite	2/9/43	Sunk	MED
Malaspina	9/10/41	Sunk	Atlantic
Marcello	2/22/41	Sunk	Atlantic
Marconi	10/28/41	Sunk	Atlantic
Medusa	1/30/42	Sunk	Adriatic
Micca	7/29/43	Sunk	MED

Submarine	Date	Fate	Location
Millo	3/14/42	Sunk	MED
Mocenigo	5/13/43	Sunk	MED
Morosini	8/11/42	Sunk	Atlantic
Murena	9/9/43	Scuttled	MED
Naiade	12/14/40	Scuttled	MED
Nani	1/7/41	Sunk	Atlantic
Narvalo	1/14/43	Scuttled	MED
Neghelli	1/19/41	Sunk	MED
Nereide	7/13/43	Sunk	MED
Ondina	7/11/42	Scuttled	MED
Perla	7/9/42	Captured off Beirut	N/A
Porfido	12/6/42	Sunk	MED
Provana	6/17/40	Sunk	MED
Remo	7/15/43	Sunk	MED
Romolo	7/18/43	Sunk	MED
Rubino	6/29/40	Sunk	MED
Saint Bon	1/5/42	Sunk	MED
Salpa	6/27/41	Sunk	MED
Santorre Santarosa	1/20/43	Scuttled	MED
Scire	8/10/42	Sunk	MED

Submarine	Date	Fate	Location
Serpente	9/12/43	Scuttled	MED
Sirena	9/9/43	Scuttled	MED
Smeraldo	9/15/41	Sunk	MED
Tarantini	12/15/40	Sunk	Atlantic
Tazzoli	5/18/43	Sunk	Bay of Biscay
Topazio	9/12/43	Sunk	MED
Torelli	9/8/43	Captured by Japanese	N/A
Tricheco	3/18/42	Sunk	MED
Tritone	1/19/43	Sunk	MED
Uarsciek	12/15/42	Sunk	MED
Uebi Scebeli	6/29/40	Sunk	MED
Velella	9/7/43	Sunk	MED
Veniero	6/7/42	Sunk	MED
Zaffiro	6/9/42	Sunk	MED

APPENDIX C

ITALIAN SUBMARINE WAR PATROLS (OCTOBER 1940-MAY 31, 1941)

Submarine	War Patrol Dates
Argo	October 02-October 24, 1940
Argo	November 22-December 12, 1940
Argo	February 27-March 28, 1941
Argo	May 19-May 31, 1941
Bagnolini	September 09-September 30, 1940
Bagnolini	October 24-November 15, 1940
Bagnolini	December 08, 1940-January 06, 1941
Baracca	September 12-October 06, 1940
Baracca	October 24-November 24, 1940
Baracca	January 19-February 18, 1941
Baracca	April 10-May 04, 1941
Barbarigo	August 13-September 08, 1940
Barbarigo	October 14-November 13, 1940
Barbarigo	February 10-March 08, 1941
Barbarigo	April 30-May 30, 1941
Bianchi	January 1941-March 04, 1941
Bianchi	April 30-May 25, 1941
Calvi	December 03-December 31, 1940
Calvi	March 31-May 13, 1941
Cappellini	October 05-November 05, 1940
Cappellini	December 22-January 30, 1941
Cappellini	April 16-May 20, 1941
Da Vinci	October 02-October 31, 1940
Da Vinci	December 21, 1940-January 20, 1941
Da Vinci	April 04-May 04, 1941
Dandolo	August 17-September 10, 1940
Dandolo	October 1940-November 15, 1940
Dandolo	January 24-February 24, 1941
Dandolo	April 09-April 22, 1941
Emo	September 09-October 03, 1940
Emo	December 05, 1940-January 01, 1941
Emo	March 03-March 19, 1941
Faa di Bruno	September 08-October 05, 1940
Faa di Bruno	October 31, 1940-Lost at Sea
Giuliani	September 14-September 30, 1940
Giuliani	November 11-December 04, 1940
Finzi	October 24-December 04, 1940
Finzi	March 10-April 17, 1941
Glauco	December 23, 1940-Jauary 1941
Glauco	January 27, 1941-February 1941

Submarine	War Patrol Dates
Malaspina	July 29-September 4, 1940
Malaspina	October 9-November 9, 1940
Malaspina	January 5-February 28, 1941
Malaspina	April 23-May 31, 1941
Marcello	November 07-December 2, 1940
Marcello	January 1941-January 24, 1941
Marcello	February 6-March 18, 1941
Marconi	September 15-September 29, 1940
Marconi	October 27-November 28, 1940
Marconi	January 16-February 17, 1941
Marconi	May 1941
Morosini	November 03-November 28, 1940
Morosini	January 22-February 24, 1941
Morosini	April 30-May 20, 1941
Nani	October 05-November 04, 1940
Nani	December 13, 1940-January 1941
Otaria	October 14-November 15, 1940
Otaria	January 24-March 01, 1941
Otaria	May 06-May 24, 1941
Tarantini	September 10-October 5, 1940
Tarantini	November 11-December 15, 1940
Tazzoli	October 09-October 24, 1940
Tazzoli	December 13, 1940-January 06, 1941
Tazzoli	April 07-May 23, 1941
Torelli	September 11-October 05, 1940
Torelli	January 05-February 04, 1941
Torelli	April 1941-May 11, 1941
Velella	December 04-December 25, 1940
Veniero	October 1940

APPENDIX D

ITALIAN SUBMARINE WAR PATROLS (JUNE 1941-JULY 1943)

Submarine	War Patrol Dates
Argo	May 31-June 12, 1941
Argo	October 24-Return to MED
Bagnolini	July 10-August 08, 1941
Bagnolini	January 18-February 22, 1942
Bagnolini	April 24-June 28, 1942
Bagnolini	September 15-November 07, 1942
Baracca	June 18, 1942
Baracca	September 06-Lost at Sea
Barbarigo	July 13-August 1941
Barbarigo	October 22-November 12, 1941
Barbarigo	January 14-February 15, 1942
Barbarigo	April 25-June 16, 1942
Barbarigo	August 29-October 1942
Barbarigo	January 24-April 03, 1943
Bianchi	July 04, 1941-Lost at Sea
Brin	June 1941
Cagni	October 06, 1942-February 20, 1943
Calvi	August 01-August 21, 1941
Calvi	December 07-December 29, 1941
Calvi	March 07-April 29, 1942
Calvi	July 02, 1942-Lost at Sea
Cappellini	June 29-July 06, 1941
Cappellini	November 17-December 29, 1941
Cappellini	May 1942-June 19, 1942
Cappellini	August 21-October 17, 1942
Cappellini	December 26, 1942-March 04, 1943
Da Vinci	June 18-July 18, 1941
Da Vinci	August 15-September 24, 1941
Da Vinci	November 19-December 02, 1941
Da Vinci	January 28-March 11, 1942
Da Vinci	May 09-July 01, 1942
Da Vinci	October 07-December 07, 1942
Da Vinci	February 20-May 23, 1943
Giuliani	June 24-September 03, 1942
Finzi	August 01-August 30, 1941
Finzi	December 07-December 29, 1941
Finzi	February 06-March 31, 1942
Finzi	June 06-August 18, 1942
Finzi	February 11-April 18, 1943
Archimede	September 1941

Submarine	War Patrol Dates
Archimede	May 01-July 04, 1942
Archimede	October-November 17, 1942
Archimede	February 26-May 1943
Malaspina	June 01-Early June 1941
Malaspina	June 27-Mid July 1941
Malaspina	September 07-October 1941
Marconi	August 03-August 29, 1941
Marconi	October 05, 1941-Lost at Sea
Morosini	June 28-July 1941
Morosini	August-September 20, 1941
Morosini	November 18-December 1941
Morosini	February 02-April 04, 1942
Morosini	June 02-August 08, 1942
Tazzoli	July 15-September 11, 1941
Tazzoli	February 02-March 31, 1942
Tazzoli	June 18-September 05, 1942
Tazzoli	November 14, 1942-February 02, 1943
Torelli	June 29-July 1941
Torelli	February 02-March 31, 1942
Torelli	June 02-July 15, 1942
Torelli	February 21-April 03, 1943
Velella	June 1941

BIBLIOGRAPHY

Archival Material

Office of Naval Intelligence, trans. *War Diary: Operations Division, German Naval Staff, 1939-1945*. Wilmington: Scholarly Resources, 1984. Microfilm.

U.S. Navy Department. *Fuehrer Conferences On Matters Dealing with the German Navy, 1939-1945*. Translated by Office of Naval Intelligence. U.S. Navy Department, 1947. Microfilm.

United States Naval Security Group, trans. *Intelligence Reports On the War in the Atlantic, 1942-1945: The Account of the War in the Atlantic from Dec. 1942 to May 1945, as Seen through and Influenced by Decryption of German Naval Radio Traffic*. Wilmington: Michael Glazier, 1979. Microfilm.

Books

Primary Sources

Bennett, G. H., and R. Bennett. *Hitler's Admirals*. Annapolis, MD: US Naval Institute Press, 2004.

Churchill. Winston S. *The Second World War Volume 5; Closing the Ring.* Boston, MA: Houghton Mifflin Company, 1951.

D'Adamo, Cristiano. “I Remember....the War Diary of Mario Daneo, an Italian Submariner in Bordeaux.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text.asp?nid=293&lid=1.

Doenitz, Karl. *Memoirs: Ten Years and Twenty Days*. Translated by R. H. Stevens. London: Weidenfeld and Nicolson, 1959.

Legnani, Antonio. “Other Info, Critical Examination-1941.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text_with_ list.asp?nid=153&lid=1&cid=4.

Rohwer, Jurgen. *Axis Submarine Successes 1939-1945*. Annapolis, MD: Naval Institute Press, 1983.

Secondary Sources

Blair, Clay. *Hitler’s U-Boat War: The Hunters 1939-1942*. New York: Random House, 1996.

Brown, David K. *Atlantic Escorts; Ships, Weapons, and Tactics in World War II*. Annapolis, MD: Naval Institute Press, 2007.

Cestra, Francesco. “Weapons: Torpedoes.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text_with_list.asp?nid=103&lid=1&cid=2.

D'Adamo, Cristiano. “Battle of the Atlantic.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text_with_list.asp?nid=89&lid=1.

———. “Battle of the Atlantic: Collaboration with the German Forces and Early Successes.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text_with_list.asp?nid=89&lid=1&cid=8.

———. “Battle of the Atlantic: End of Joint Operations.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text_with_list.asp?nid=89&lid=1&cid=7.

———. “Cb Submarine Oceanic-Calvi.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/classes.asp?class=Calvi&nid=162&lid=1.

———. “Italian Submarine Fleet.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text.asp?nid=82&lid=1.

———. “Marcello.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text_with_list.asp?nid=164&lid=1.

———. “Marconi Submarine-Oceanic: Marconi.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/classes.asp?class=Marconi&nid=165&lid=1.

———. “The Integration of Betasom with the German Command Structure.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text.asp?nid=95&lid=1.

———. “The Italian Submarine Base in Bordeaux, France.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/detail_text.asp?nid=90&lid=1.

———. “Total Sinking: By Submarine.” Regia Marina Italiana. Accessed July 29, 2014. http://www.regiamarina.net/sub_actions_stat.asp?nid=195&lid=1.

de le Vega, Julio. “Operation Ursula and the Sinking of Submarine C-3.” uboat.net. Accessed August 19, 2014. http://www.uboat.net/articles/59.html.

Hague, Arnold. *The Allied Convoy System 1939-1945.* St. Catharine's, Ontario: Vanwell, 2000.

Ireland, Bernard. *The Battle of the Atlantic.* Annapolis, MD: Naval Institute Press. 2003.

Kuehn, John T. *Agents of Innovation.* Annapolis, MD: Naval Institute Press, 2008.

———. "Terrorists and Submarines: Lessons for Afghanistan from the Antisubmarine Campaign of World War I." *Joint Forces Quarterly*, no. 58 (3rd quarter 2010): 105-8.

Mullen, M. G. *The National Military Strategy of the United States of America 2011*. Accessed August 20, 2014. http://www.army.mil/info/references/docs/NMS%20FEB%202011.pdf.

Nesbit, Roy Conyers. *The Battle of the Atlantic*. Phoenix Mill: Sutton Publishing Limited- 2002.

Nimitz, Chester W., Henry H. Adams, and E. B. Potter. *Triumph in the Atlantic: The Naval Struggle Against the Axis.* Englewood Cliffs, NJ: Prentice-Hall, 1960.

Roskill, Stephen. *Battle of the Atlantic.* New York: David McKay Publishers, 1976.

Sadkovich, James J. *The Italian Navy in World War II*. Westport, CT: Greenwood Press. 1994.

Smith, Kevin. *Conflict over Convoys: Anglo-American Logistics Diplomacy in the Second World War*. New York, NY: Cambridge University Press, 1996.

Syrett, David. *The Defeat of the German U-Boats; The Battle of the Atlantic*. University of South Carolina Press, 1994.

uboat.net. "U-Boat Patrols." Accessed August 21, 2014. http://www.uboat.net/boats/patrols/.